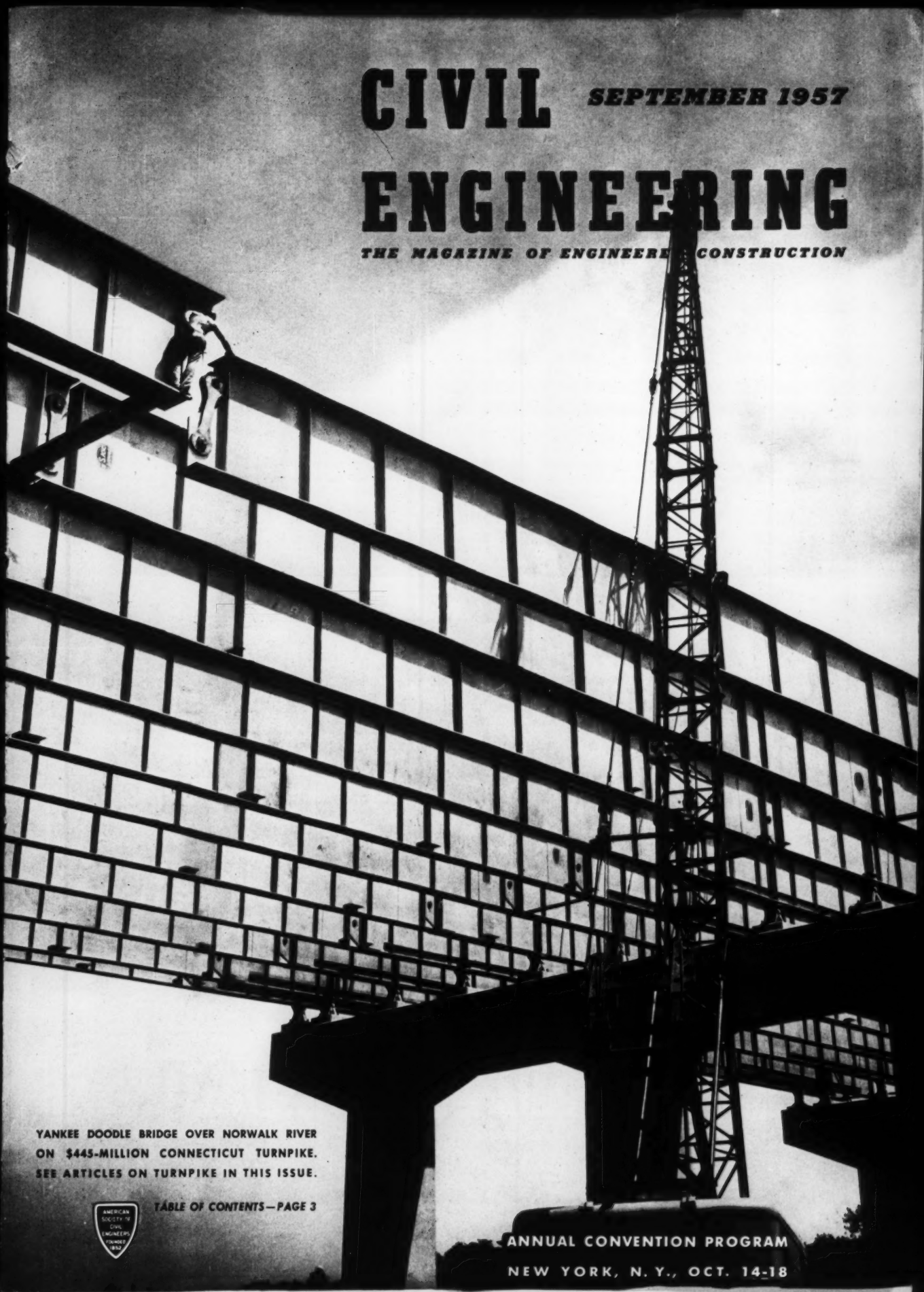
CIVIL ENGINEERING

SEPTEMBER 1957

THE MAGAZINE OF ENGINEERED CONSTRUCTION



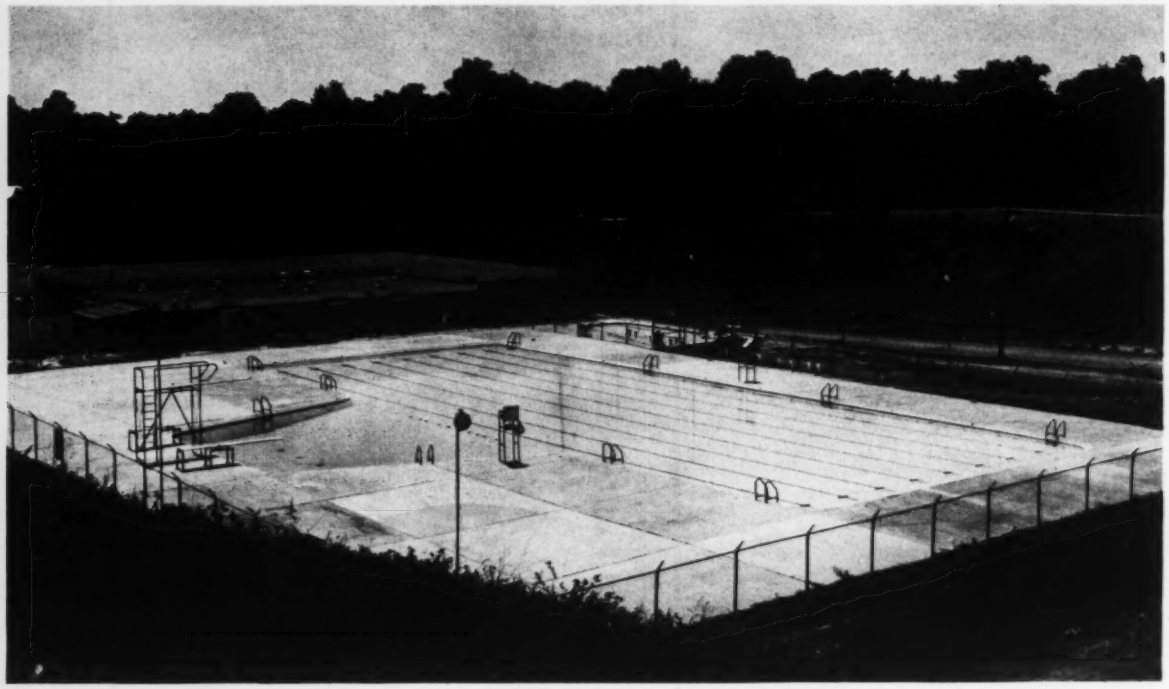
YANKEE DOODLE BRIDGE OVER NORWALK RIVER ON $445-MILLION CONNECTICUT TURNPIKE. SEE ARTICLES ON TURNPIKE IN THIS ISSUE.

TABLE OF CONTENTS—PAGE 3

ANNUAL CONVENTION PROGRAM

NEW YORK, N. Y., OCT. 14-18

America's Finest Engineered Pool



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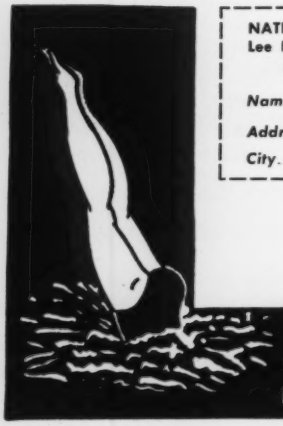
NATIONAL manufactures a complete line of superior equipment—underwater lights, vacuum cleaners, filters, etc. We retain a highly specialized engineering staff. Services of our staff are available, if desired, to all engineers and architects.

National Pool Equipment Company extends you a cordial invitation to visit us at Booth No. 44-45, during the ASCE Convention



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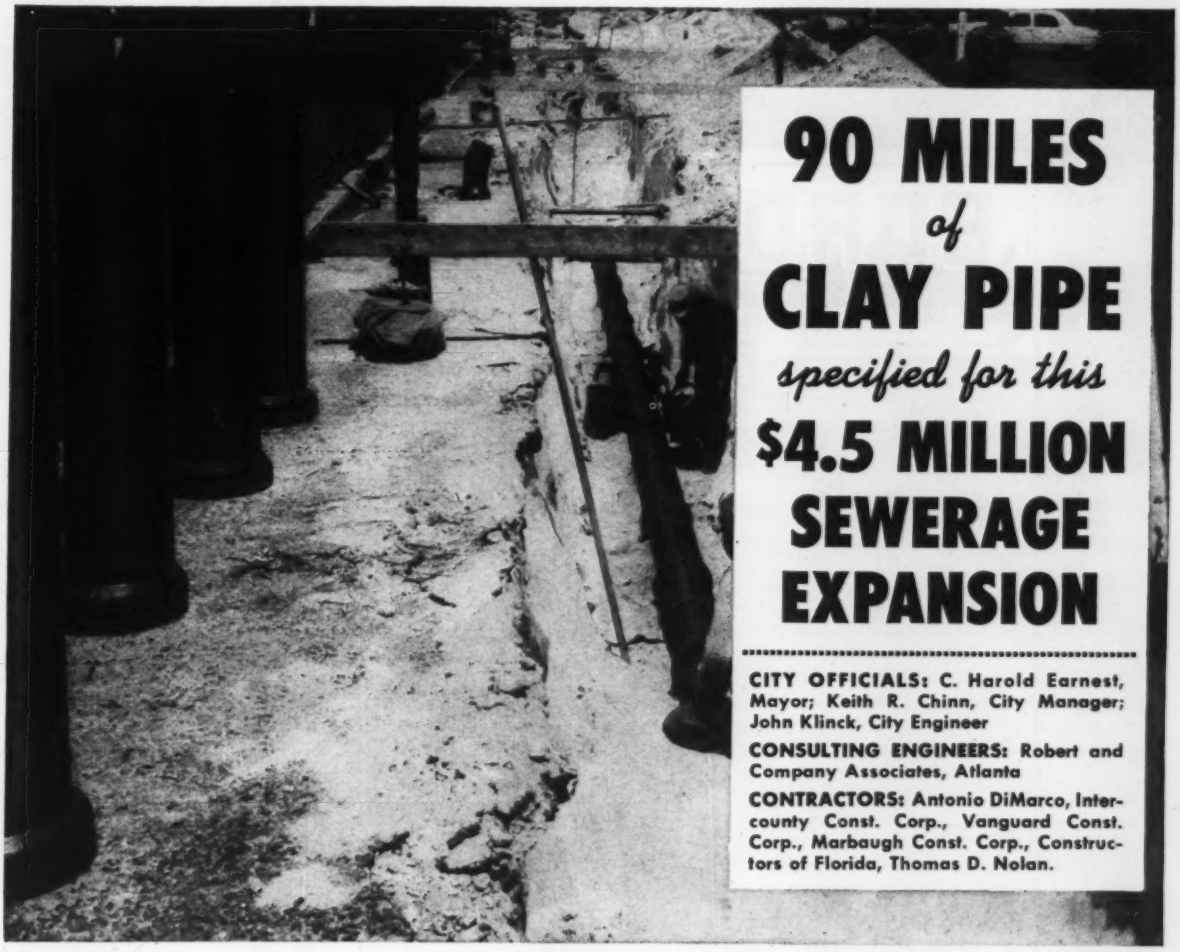

90 MILES of CLAY PIPE specified for this $4.5 MILLION SEWERAGE EXPANSION

CITY OFFICIALS: C. Harold Earnest, Mayor; Keith R. Chinn, City Manager; John Klinck, City Engineer

CONSULTING ENGINEERS: Robert and Company Associates, Atlanta

CONTRACTORS: Antonio DiMarco, Intercounty Const. Corp., Vanguard Const. Corp., Marbaugh Const. Corp., Constructors of Florida, Thomas D. Nolan.

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Vitrified CLAY PIPE
CLAY PIPE NEVER WEARS OUT!

CIVIL ENGINEERING, September 1957. Vol. 27, No. 9 • Published monthly by the American Society of Civil Engineers. Publication office Concord, New Hampshire. (Second-class mail privileges authorized at Concord, New Hampshire.)

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Light aluminum grating for SUN SHADES on schools is in perfect harmony with modern school design — allows 80% passage of light and air without the accompanying penetrating rays of the sun. Because they are aluminum they are maintenance-free. Furthermore, they provide a permanent working platform for easy access to windows.

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45,700 copies of this issue printed

CIVIL ENGINEERING

SEPTEMBER 1957
VOL. 27 • NO. 9

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• ARTICLES

John R. Dietz 43 **Scholarships for highway engineers**
Edward R. Estes, Jr. 44 **Plastic design of warehouse saves steel**
Henry A. Sikso 48 **Chalk used as construction material at Gavins Point Dam**
J. K. Finch 51 **The engineer through the ages—Roman Republic, Part 2**
D. L. Narver, Jr. 54 **Is sterilization of sewage by irradiation economical?**
56 **Connecticut Turnpike**
N. E. Argraves 56 Big push for completion
H. L. Blakeslee 60 Construction in New Haven area
A. S. Wikstrom 64 Ingenuity licks bridge foundation problems
68 **How to recruit graduating engineers**
Wayne F. Palmer 68 From the viewpoint of a consulting engineer
Roy T. Sessums 69 From the viewpoint of an industry
Rex M. Whitton 70 From the viewpoint of the state highway department
S. R. Hanmer 71 From the viewpoint of the Corps of Engineers

• SOCIETY NEWS

73 **PROGRAM of ASCE Annual Convention**
86 **Fantastic future for prestressed concrete predicted at San Francisco Congress**
87 **Actions of the Executive Committee briefed**
88 **Department of Conditions of Practice meets**
89 **Site selected for new Engineering Center**
90 **Division Doings**
M. J. Shelton 91 **Getting more students into engineering**
92 **Notes from the Local Sections**
96 **By-line Washington**

• NEWS BRIEFS

100 **Earthquake damages Mexico City buildings**
101 **Cast-in-place concrete shell structure bid below precast structure**
101 **Pan-American Highway Congress in Panama**
104 **Concrete courthouse saves hundreds from hurricane**

• DEPARTMENTS

30 News of Engineers
39 Am-Soc Briefs
41 Do You Know That?
84 The Readers Write
94 Scheduled ASCE Meetings
106 N. G. Neare's Column
112 Deceased
122 Non-ASCE Meetings
128 Recent Books
128 Positions Announced
132 Men and Jobs Available
134 Applications for Admission
138 Equipment, Materials, and Methods
152 Literature Available
153 Films Available
154 From the Manufacturers
160 Index to Advertisers
155 **Proceedings Papers Available**

How to select the right flow-measuring device

Selecting the correct device is simply a matter of choosing the one that best meets your requirements. The wide variety of Simplex Primary Elements makes this selection easy.

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SIMPLEX VENTURI TUBES produce a minimum head loss—returning 85% to 90% of the differential head developed for meter operation. Since pressure differentials are measured between the main and throat sections, the tubes are smooth, true in shape and of accurate diameters to produce a stable coefficient of discharge. This gives you accuracy over wide flow ranges . . . accuracy within ±0.3% if required.

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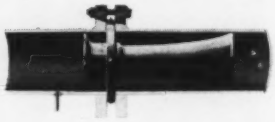
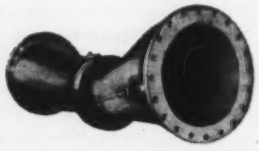
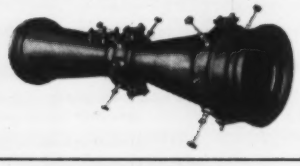
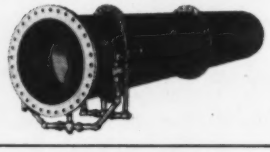
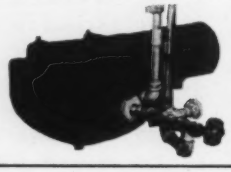
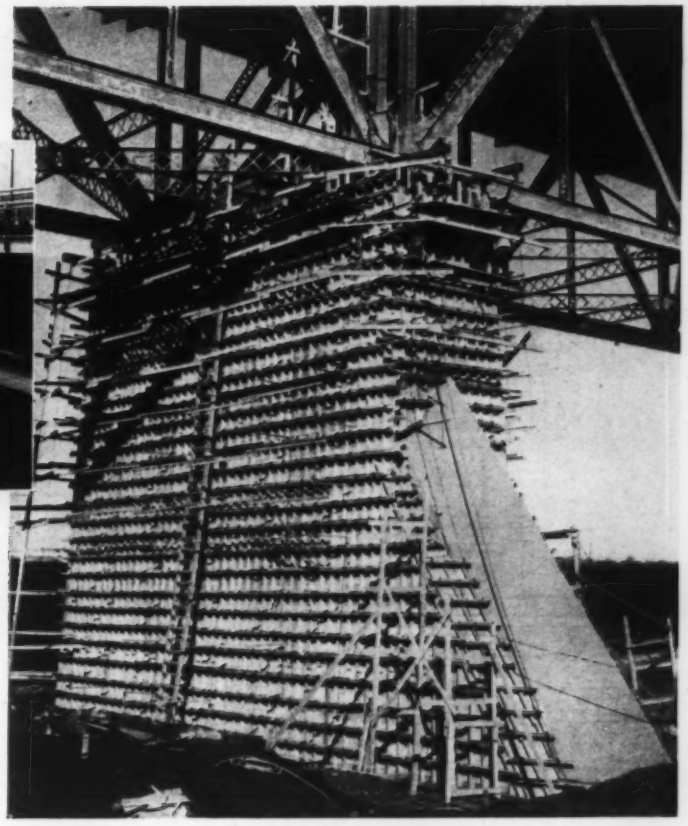
FLOW CONDITION		SOLUTION
NORMAL WATER, AIR OR GAS FLOWS		TYPE VT—STANDARD VENTURI TUBES Cast iron with bronze bushed main piezometer holes and bronze throat liner. Flanged, bell or spigot ends. Inspection opening at throat. Special metals for high pressures or caustic liquors, corrosive gases, brines, etc. BULLETIN 005
NORMAL WATER, AIR OR GAS FLOWS		TYPE TG—INSERT TUBES AND NOZZLES Withstand high pressures. Fit inside existing lines . . . permitting light construction. This, plus *short length*, cuts costs. BULLETIN 100
SMALL FLOWS OF WATER, GASES CORROSIVE FLUIDS		TYPE TF—MINIATURE VENTURI TUBES Machining to .0005" assures accuracy. Main diameters as low as ½"; throat diameters down to .1". Welded stainless steel models for high pressures. BROCHURE
NORMAL SEWAGE, SLUDGE, TRADE WASTES		TYPE VTJ—SINGLE TAP VENTURI TUBES Single taps at main and throat have bayonet-type valve for fast cleaning. Absence of pressure belts prevents clogging. Inspection opening at throat. BULLETIN 005
NORMAL SEWAGE, SLUDGE, TRADE WASTES		TYPE VS—FOUR TAP VENTURI TUBES Four cleaning valves at main and throat can be operated manually, by air, or hydraulically to keep piezometer holes clear for top accuracy. Two hand holes on each pressure belt and inspection opening at throat. BULLETIN 005
LOW-VELOCITY SEWAGE, HEAVY WASTES		TYPE VE—ELLIPTICAL VENTURI TUBES Developed specifically to accurately measure low-velocity sewage, sludge and heavy trade wastes—under low pressures. *Flat top* prevents air binding. *Flat bottom* is self-scouring. Inspection opening at throat. BROCHURE
LOW-HEAD SEWAGE, SLUDGE, TRADE WASTES		TYPE S—PARABOLIC FLUMES Full 20:1 range for open flows. Accuracy ±2%. Flanged, bell or spigot inlet for 6 to 36" lines. Integral sediment trap, piezometer reamer, gauge glass, direct-reading flow scale. BULLETIN 801

Consulting Engineer: Dr. P. L. Pratley
General Contractor: Dominion Bridge Co. Ltd.
Substructure Contractor: Atlas Construction Co. Ltd.
Concrete Contractor: Intrusion-Prepakt, Ltd.
Photos: Courtesy of Roads and Engineering Construction

Piers in foreground have been enlarged with Prepakt concrete, completing the initial stage of a complex bridge reconstruction project.



Prepakt concrete was used to enlarge eleven piers of the Jacques Cartier Bridge, demonstrating the advantages of I-P methods — high strength, ease of placement and flexibility of operation.

Prepakt speeds reconstruction of St. Lawrence Seaway bridge

Intrusion-Prepakt, Ltd. recently played a vital role in the reconstruction of the Jacques Cartier Bridge at Montreal. The highly complex project was undertaken to provide minimum clearance of 120 feet for ocean-going vessels soon to use the St. Lawrence Seaway canal. Fourteen spans of the bridge, a total of 2625 feet in length, will be jacked up to new elevations on raised piers, a new end span will be inserted and the center span replaced—all without disturbing traffic.

Recognizing the advantages of Prepakt, Seaway authorities specified its use for increasing the thickness of eleven piers an average of 1½ feet on all surfaces. Selected coarse aggregate was placed in the forms and consolidated with Intrusion grout to form high-strength Prepakt concrete encasements. The extremely low shrinkage of Prepakt concrete provided a solid monolithic structure with a tight bond to reinforcement and old concrete.

Advantages in time saved and ease of placement have made Intrusion-Prepakt methods and materials particularly well suited to all types of bridge reconstruction and rehabilitation projects. For further information and descriptive engineering report, contact Intrusion-Prepakt, Inc., Room 568-J, Union Commerce Building, Cleveland 14, Ohio. In Canada: Intrusion-Prepakt, Ltd., 159 Bay Street, Toronto, Canada.

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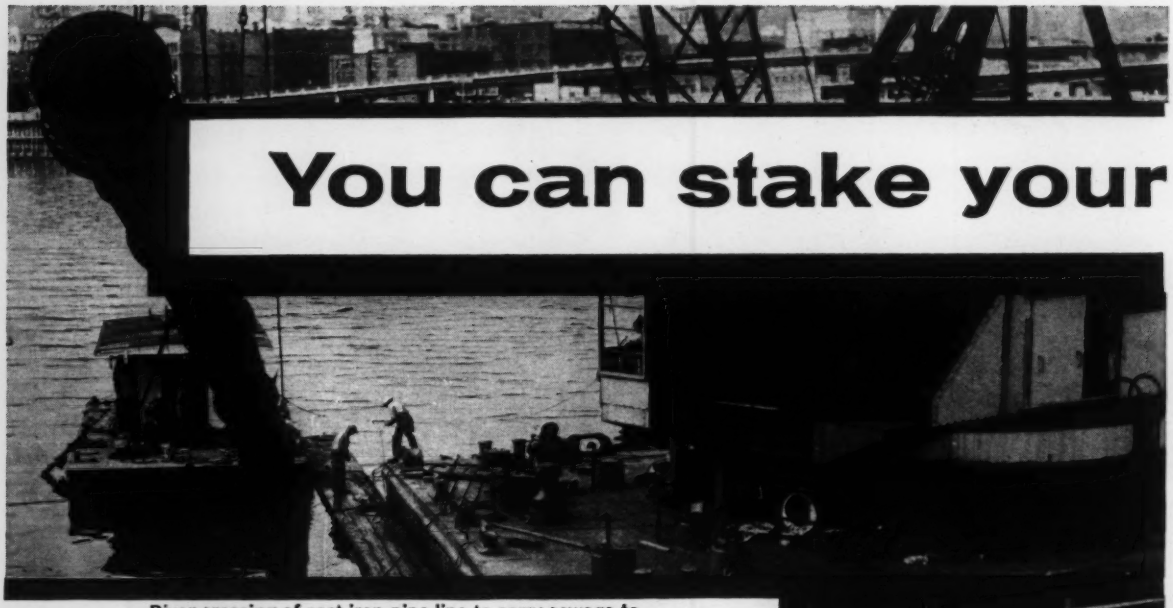
Intrusion and Prepakt are trade marks of Intrusion-Prepakt, Inc., whose methods and materials are covered by U. S. Patents Nos. 2313110, 2655004, 2434302 and others, also patents pending.

You can stake your



River crossing of cast iron pipe line to carry sewage to disposal plant at Portland, Oregon.

Whether you select a man or a product, you judge dependability on the record.

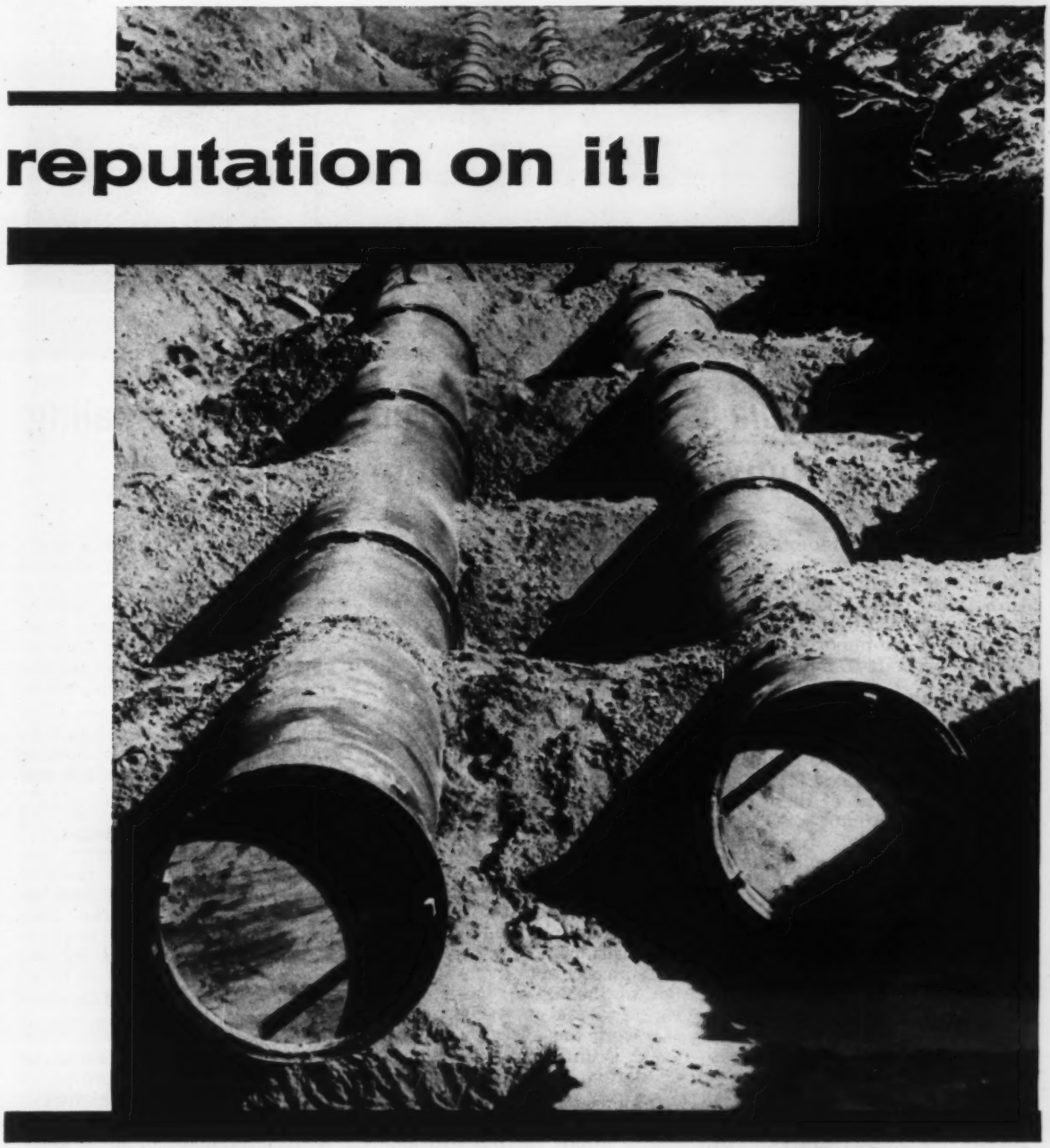
Cast iron pipe's record is unmatched. Proof? Today nearly seventy cities are still using cast iron mains that have been in continuous use for a hundred years and more!

More important, the *modernized* cast iron pipe now being produced is even tougher, stronger . . . more reliable and efficient.

Specify cast iron pipe and you assure the long life, dependability and economy that protect *your* reputation.

Cast iron pipe for large automobile assembly plant in New Jersey.

reputation on it!



Installing large diameter cast iron pipe lines supplying water to synthetic fibre plant in South Carolina.

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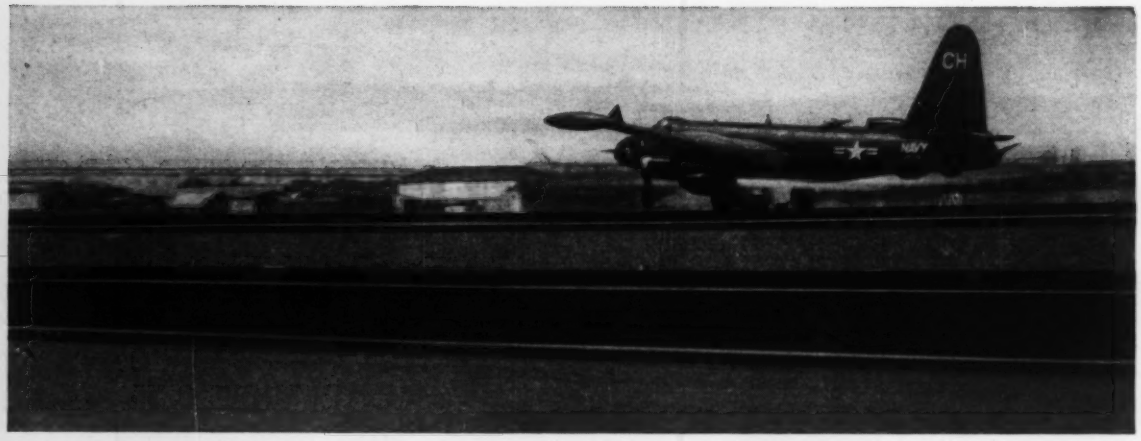
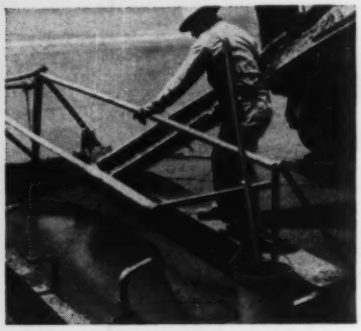
Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.



Navy gets double savings with Bitumuls Slurry Sealing of Runways at Jet Training Station

ONE of the busiest military air installations on the entire West Coast is the Alameda Naval Air Station. In addition to heavy traffic in propeller-driven aircraft, Alameda is an important West Coast jet aircraft training center.

Runway Construction—The runways of this Naval Air Station are surfaced with asphaltic concrete, placed over a 6" course of Bitumuls Sand Mix. The wide shoulders adjacent to these runways are also Bitumuls RS-1 Chip Seal. The surfacing was placed some four years ago, and recently showed signs of weathering. Close



Bitumuls Slurry is chuted into spreader-box as mix-truck travels at speeds up to 5 MPH.

inspection disclosed some ravelling; minor hair-cracks on the surface; and some loose material. This loose material, while of little importance during the days of conventional-type aircraft, had become a major source of expense after jets started operating here. Sand, small stones, and other loose material can cause considerable damage, when scooped into the jet engines.

A Dual Problem—The Navy was looking for answers to two problems: First, a method of revitalizing the runways and extending the life of the pavement surface. Second, a means of cutting down the repair bills involved when jet engines were damaged by loose material scooped up from the surface of the runways. *They found a single answer to both these problems in Bitumuls Slurry Seal!*

Bitumuls Slurry Seal composed of fine, sharp aggregate, Bitumuls Mixing Grade emulsified asphalt and water, was mixed in transit-mix trucks to a free-flowing, slurry consistency. It was applied by the squeegee action of a spreader-box to 350,000 sq. yards of runway and taxi-way. Contract for this work was awarded to George Reed, a contractor from Modesto, California.

To offset the high abrasive action of the aircraft tires on landing, a dilute (3 to 1) Bitumuls tack coat was placed ahead of the Slurry Seal to insure maximum adhesion.

Fast-Fast Application—It was "business-as-usual" at the Air Station while this work was in progress. In spite of the additional requirement of the tack coat, Bitumuls Slurry Sealing reduced interference with air traffic to a minimum. Planes at the Station were able to taxi over the fresh seal coat four hours after application. Jet aircraft landed on the new seal 24 hours after application.

The costs involved in providing this new life for the existing runway pavement was considerably less than that of a normal seal coat application.

"Meanwhile, at the Hangar..." In the repair shops, an extra "bonus" economy will be realized because Bitumuls Slurry Seal has eliminated loose material from the runways. *The cost of mechanical repairs occasioned by the induction of foreign material through the jet engines is expected to be sharply reduced.*

A Proved Procedure—Bitumuls® Slurry Seal has been proved on many installations—on highways, streets and airport runways—in terms of economy of initial application, and also in terms of durability. It can be applied in any quantity or volume for either construction or maintenance. Call our nearest office if you need additional information. It will be given gladly; and, of course, without obligation.

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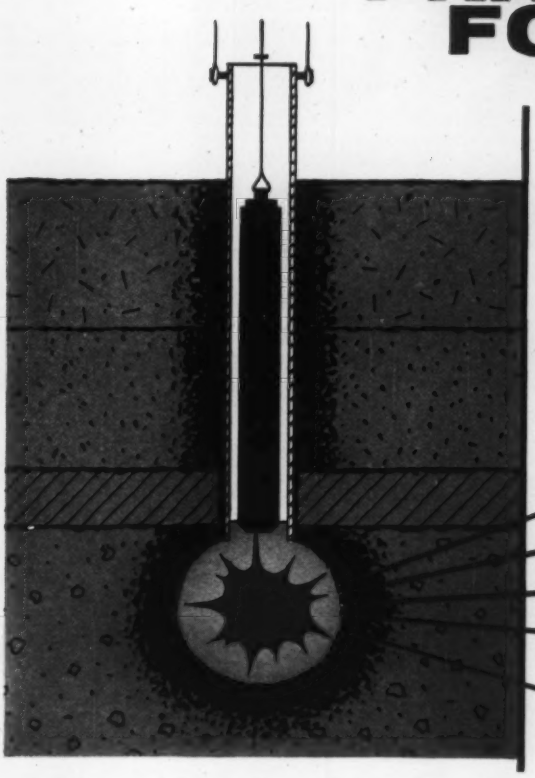

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After completion of the pressure injected footing, these two options are available:

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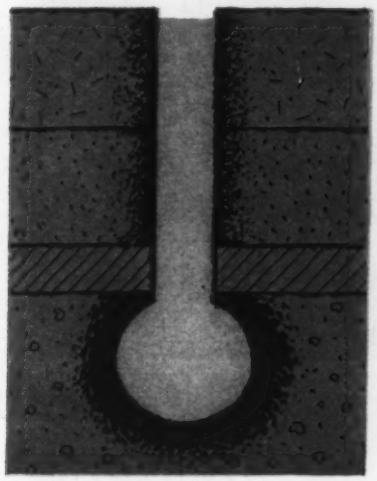

Children's Hospital Addition
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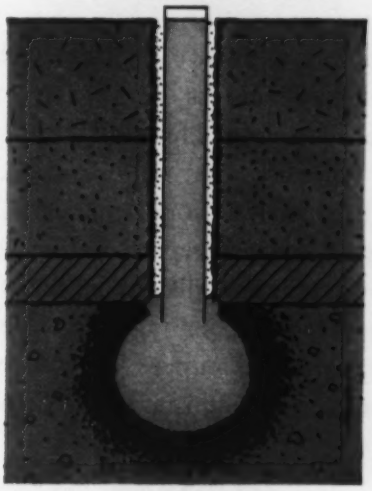
Cased Shaft



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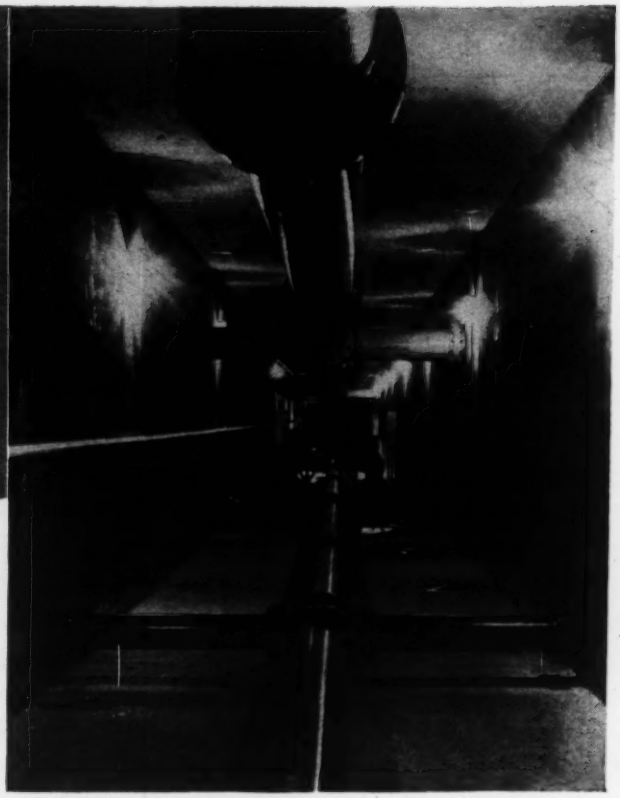


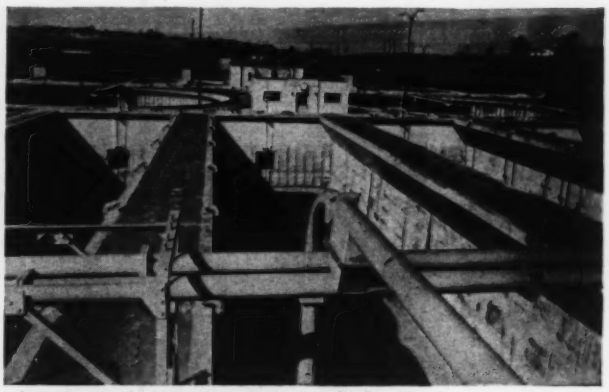
AMERICAN CAST IRON PIPE

Modern plant design incorporates both efficiency and economy. That's why piping in the $1,500,000 Village Creek Sewage Treatment Plant of Jefferson County, Alabama, is American Cast Iron Pipe.

The high flow capacity, strength, and resistance to corrosion of American Cast Iron Pipe contribute to efficient operation of any modern plant. Its long, trouble-free service life adds the assurance of economy, as well.

Get in touch with your American Cast Iron Pipe Company representative while your new plant or addition to an existing system is in the planning stage. You'll find his up-to-the-minute knowledge of modern methods and materials helpful.

Pipe gallery with sludge suction, scum, and drain piping from primary clarifiers. American Cast Iron Pipe and Fittings.



Aeration tank, metering station and primary clarifiers at Village Creek Sewage Treatment Plant, Pratt City, Alabama.

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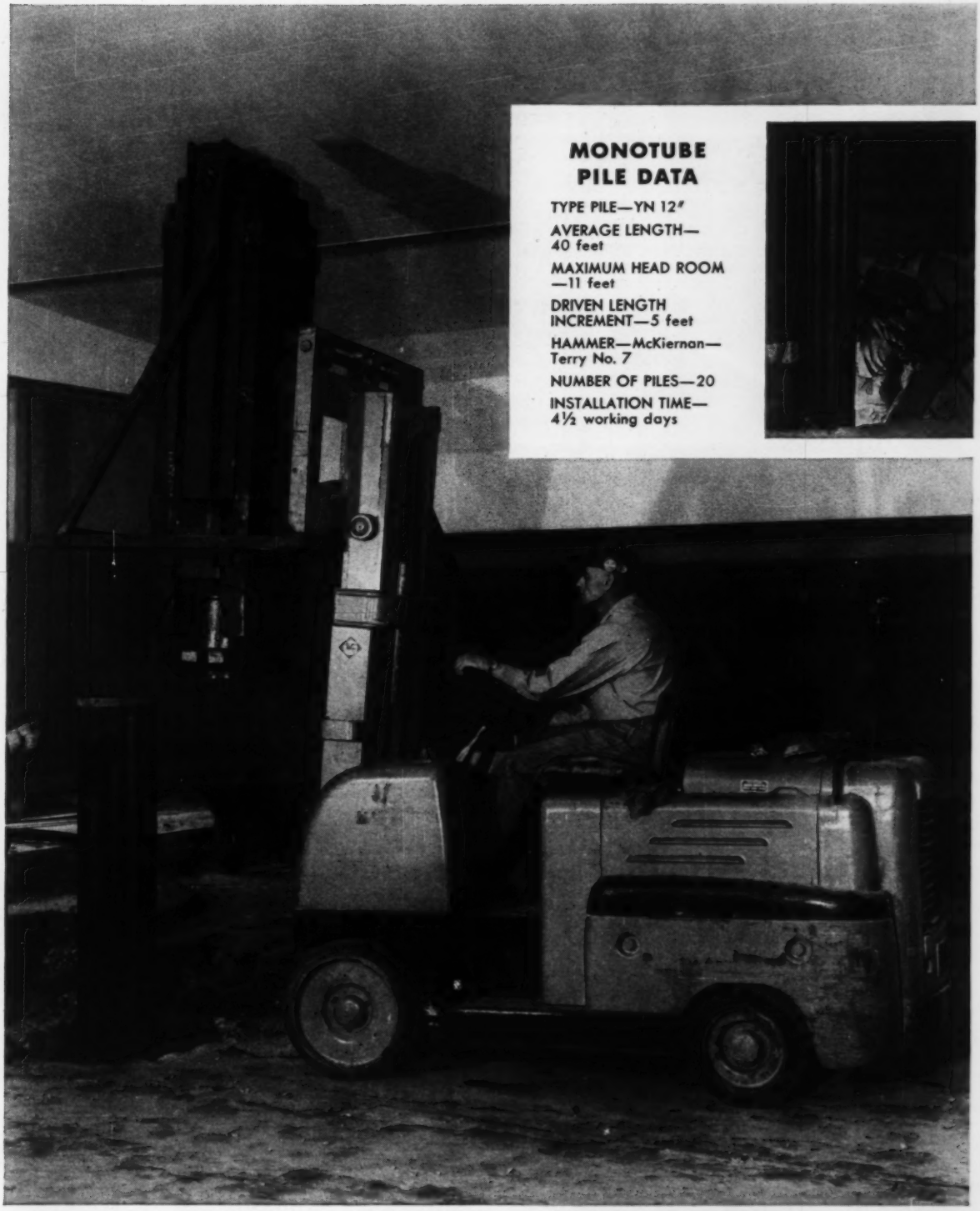


MONOTUBE PILE DATA

TYPE PILE—YN 12″

AVERAGE LENGTH—40 feet

MAXIMUM HEAD ROOM—11 feet

DRIVEN LENGTH INCREMENT—5 feet

HAMMER—McKiernan—Terry No. 7

NUMBER OF PILES—20

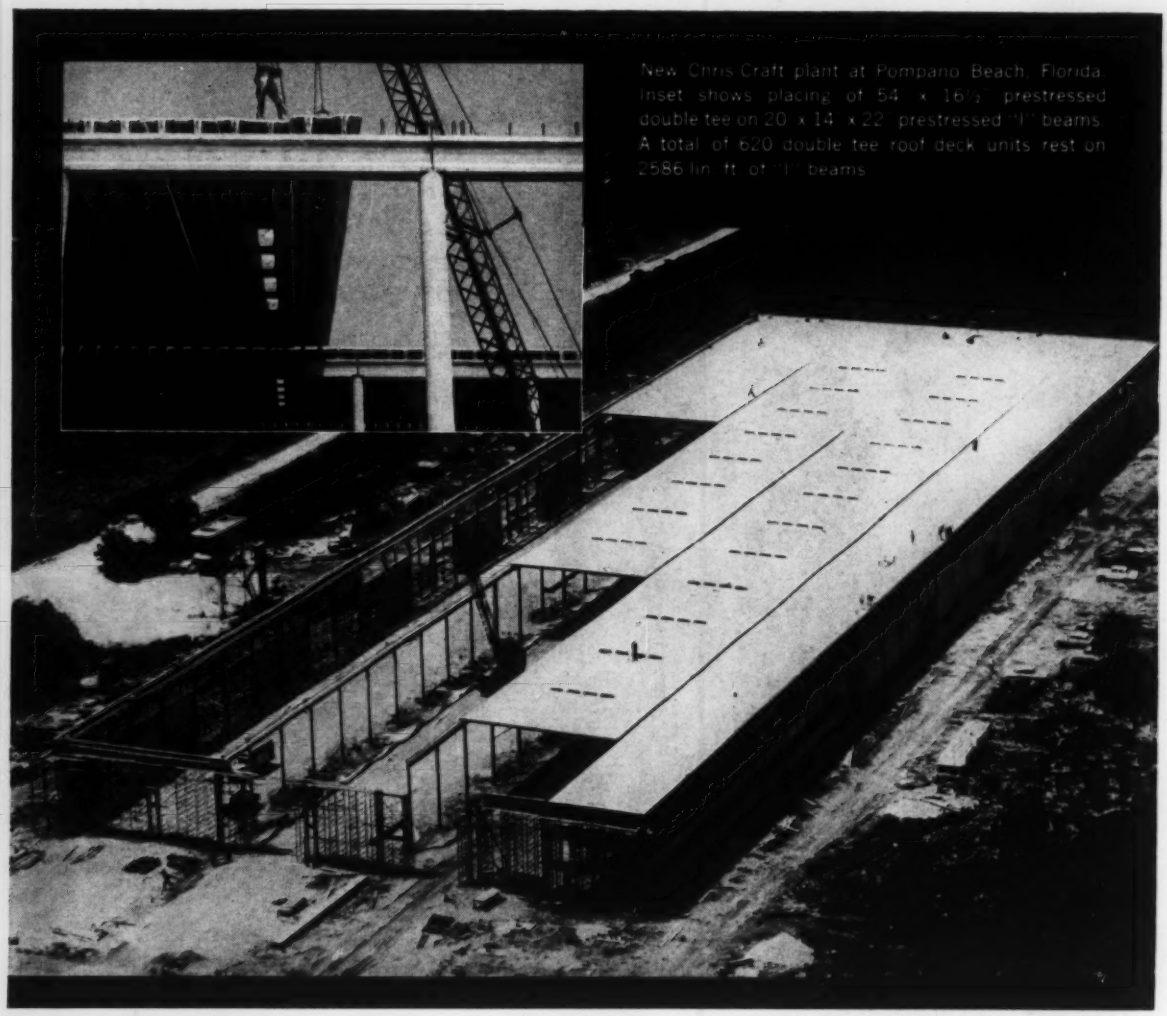
INSTALLATION TIME—4½ working days

ADAPTABILITY plus ECONOMY with Monotube piles . . . ideal for underpinning projects where conditions are difficult, and rapid job completion is important. Monotubes are easily cut to required lengths, easily handled, easily assembled and easily driven despite low head room.

Tapered, fluted Monotube piles are available in lengths, diameters and gauges to meet every requirement. Write The Union Metal Manufacturing Co., Canton 5, Ohio for complete information.

UNION METAL

Monotube Foundation Piles



New Chris Craft plant at Pompano Beach, Florida. Inset shows placing of 54" x 16½" prestressed double tee on 20" x 14" x 22' prestressed "I" beams. A total of 620 double tee roof deck units rest on 2586 lin. ft. of "I" beams.

120,688 sq. ft. of prestressed roof deck placed in 9 working days

It took only 9 working days for a 5-man crew using a 20-ton crane to place the double tees for this 623' x 194' roof deck. Fast, economical results like this are one of the big reasons for the rapidly growing use of prestressed concrete.

For matching speed and economy in precasting the units for this job, Lewis Manufacturing Company used LEHIGH EARLY STRENGTH CEMENT. "Our entire operation," writes Mr. Lewis, "has always been geared to the use of Lehigh Early Strength Cement and live steam curing. This fast, economical production method enables us to give our customers better service, at lower cost."

This job is a typical example of the advantages of both prestressed concrete and Lehigh Early Strength Cement in modern construction.

Contractor: Witters Construction Co.
Hialeah, Florida

Prestressed Units Manufactured and Erected By: Lewis Manufacturing Company, Miami, Florida

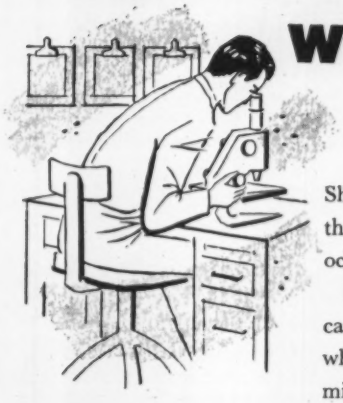
- LEHIGH EARLY STRENGTH CEMENT
- LEHIGH MORTAR CEMENT
- LEHIGH PORTLAND CEMENT
- LEHIGH AIR-ENTRAINING CEMENT

LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa.

Microscopic Enemies?

Magnification 800X

Layne Research Defends Your Well Water Supply



Shown here is an actual photograph of one of the many microscopic organisms which may occur in any type water supply.

Layne Research is called upon when well capacity is reduced. Layne Research finds out why. Production records, water analysis and microscopic examinations are some of the methods used to find the reason. Layne Research, thru years of experience in "recovering lost water," selects the correct Laynite material and method to restore well capacity.

IDENTIFY AND PRESCRIBE — that's what Layne Research does for each individual well water problem.

Only Layne Offers Complete Service: *Research* • *Analysis* • *Design* • *Wells* • *Pumps* • *Maintenance* • *Engineering*

1882 — 1957
Layne
75 YEARS OF PROGRESS

WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

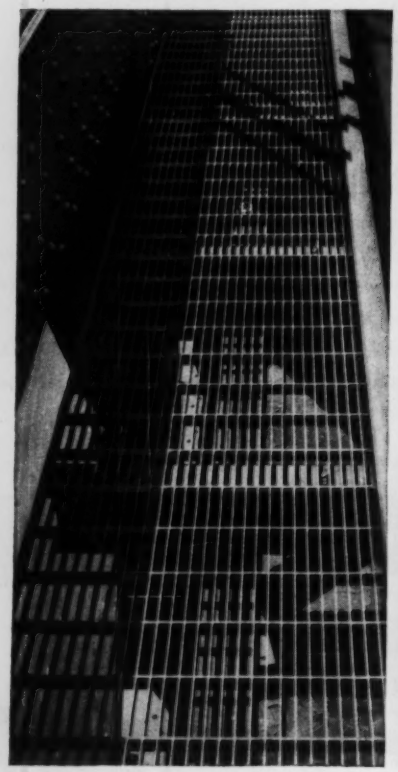
LAYNE & BOWLER, INC. MEMPHIS

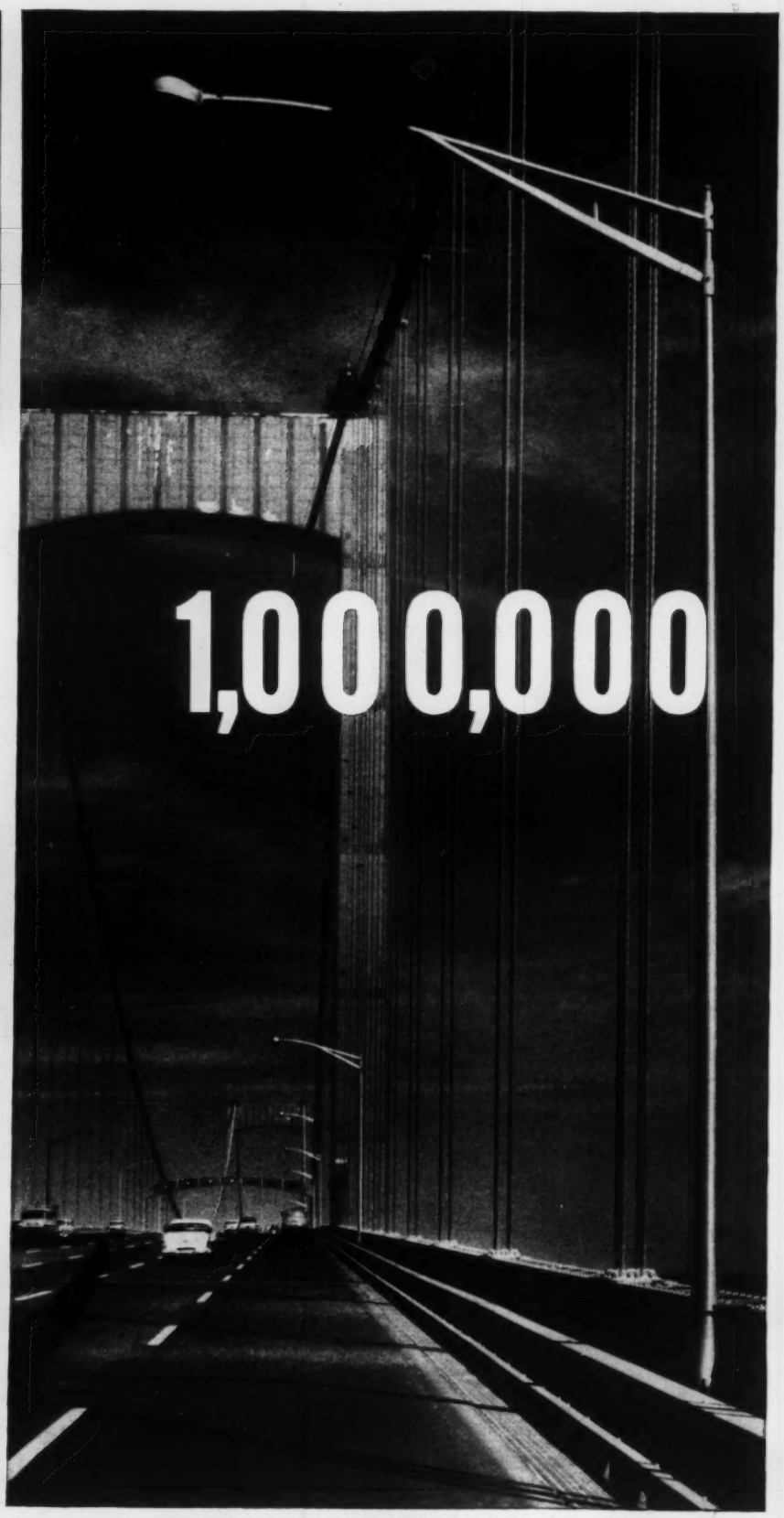
General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

MORE THAN SEVEN MILES OF ALUMINUM RAILINGS AND FENCING guard the bridge's approaches and main span. Comparable in first costs to steel, they will save countless dollars in maintenance costs and end all painting problems.

MORE THAN A MILE OF ALUMINUM GRATINGS on both sides of the Walt Whitman bridge provide safe walkways for stranded motorists and workmen. Gratings weigh 66% less than steel, require less costly supporting structures, yet meet all loading requirements. Next-to-impossible painting is eliminated.





The new Walt Whitman Bridge soars 3,500 feet across the Delaware River to link the Pennsylvania and New Jersey turnpikes. Modjeski and Masters—Ammann and Whitney were consulting engineers. Bethlehem Steel Company was general contractor.

POUNDS OF ALCOA ALUMINUM

make Walt Whitman bridge lighter, stronger, longer lasting

Endless, expensive maintenance and painting will never be a problem with Philadelphia's new Walt Whitman Bridge. A record-breaking 1,000,000 pounds of aluminum guard against that. Railings, lighting standards, gratings, fencing, huge overhead traffic signal arches and sign trusses . . . made of Alcoa® Aluminum, the light, strong metal that lasts.

Aluminum will not rust . . . it defies moisture, industrial fumes, corrosive atmospheres of all types. It retains its original attractive appearance indefinitely.

And because aluminum is lighter and simpler to handle, it saves bridge builders money . . . fewer men and equipment are needed to install it.

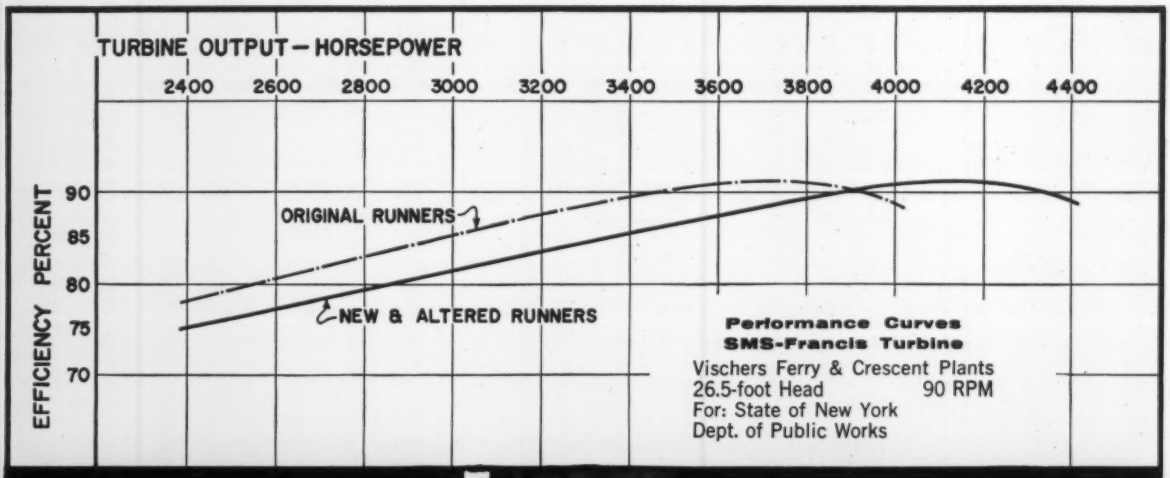
A complete range of bridge accessories and structural parts is available from Alcoa and its many customer fabricators and Jobber-Erectors. Our 30 years of experience in the bridge field, developing lighter, stronger, longer-lasting alloys, is at your service. Write Aluminum Company of America, 1979-J Alcoa Building, Pittsburgh 19, Pennsylvania.

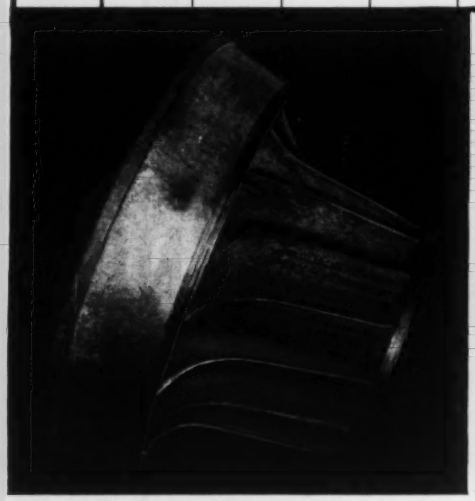
Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

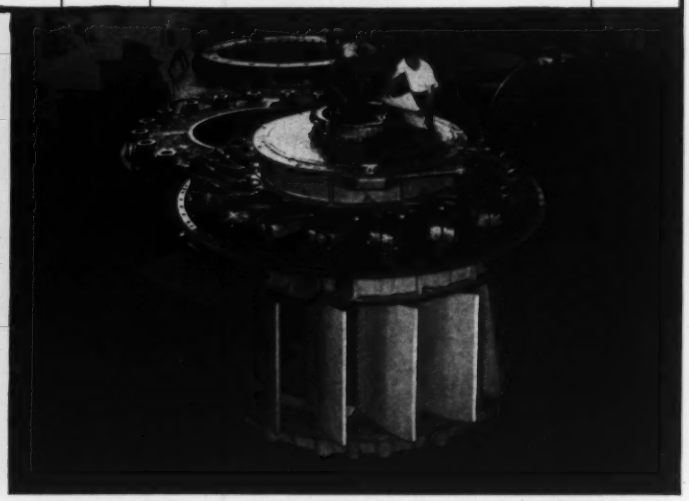
THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

LIGHTING STANDARDS, TRAFFIC ARCHES AND TRUSSES OF ALUMINUM survive the worst kinds of weathering, maintain corrosion-free strength and attractive appearance throughout the years. Lighting standards like these will stand up to winds of hurricane velocity!





Modifed runner for Vischers Ferry unit #4. Note excellent condition of runner after long initial service.



The rebuilt distributor of Crescent unit #1 is checked during final assembly in the SMS shops.

Rehabilitation of 34-Year-Old SMS Turbines **TO INCREASE POWER 10%**

Here's how hydro plants, operating on relatively low heads, can have rehabilitated turbines to get increased power and higher efficiencies. At the Vischers Ferry and Crescent Plants on the Mohawk River north of Albany, New York, four 86-inch SMS-Francis turbines have recently been rebuilt. Their increased capacity is shown in the curve above.

These SMS runners were in good mechanical condition after an average of 34 years of service. There was no evidence of weakness or failure, no erosion, and very little cavitation. Only minor modifications were needed on the bucket and throat to reshape them in accordance with modern designs and increase their output. SMS furnished a new runner to replace the first one removed, so that by rehabilitating one unit at a time and using the runner as a replacement for the next unit, outage time was kept to a minimum and the last runner has become a spare.

Modernization and rehabilitation of existing facilities can often be the answer to your need for more power at low cost. At SMS, you will find the most modern laboratory, engineering, and manufacturing facilities available. To obtain a general discussion of turbine rehabilitation given at a recent technical presentation, write on your letterhead to S. Morgan Smith Company, York, Pennsylvania.

More Power To . . .

S. MORGAN SMITH

SMS

HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

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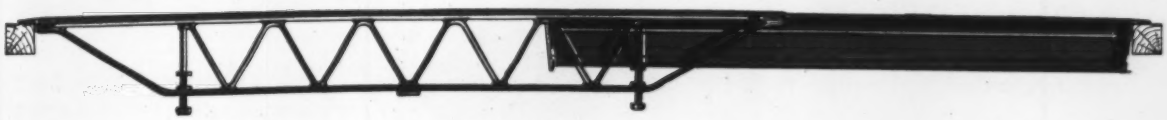


NEWEST EQUIPMENT FOR BEAM AND SLAB CONCRETE FLOOR FORMS— SAVES UP TO **40%**

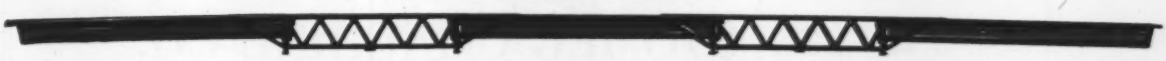
Use SPANALL once, and you'll never again build forests of costly vertical steel or timber shoring. Because SPANALL makes this type of formwork construction safe, easier and faster. Contractors report *direct* savings up to 40% in time as well as money, plus additional *indirect* savings that accrue from access to floors below the forms—floors with wide open spaces invitingly free and clear for storage or for getting a head start on other work. Newly published Catalog details all the cost-saving advantages; ask your distributor for your copy. Or write us direct.

Engineered for generous load-bearing capacities based on safety factor of 2.17, SPANALL applies to all types of construction: flat slab—beam and slab—structural steel—metal pan—drop head—filler block, etc.

SPANALL OF THE AMERICAS, INC.

787 United Nations Plaza • New York 17, N. Y.

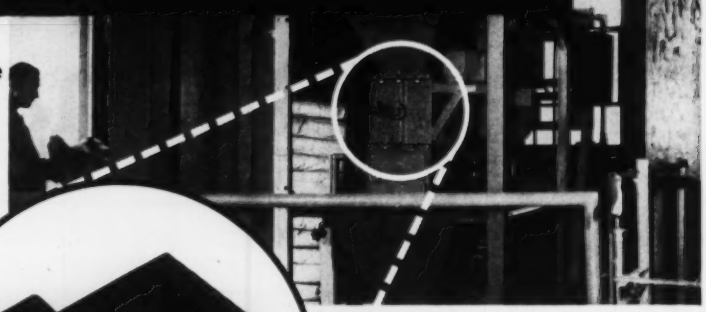
For detailed information, write Dept. C



Simple adjustment sets correct camber as sections assemble to wide range of span lengths without need for intermediate vertical shoring

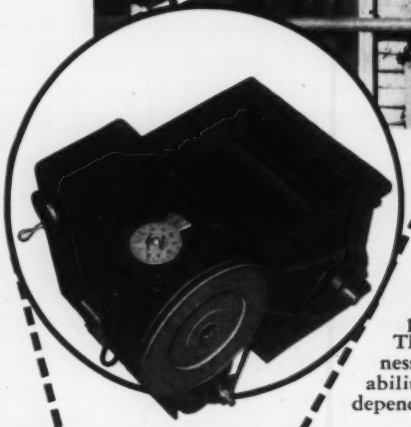
FEEDING CARBON?

★ ACCURATELY? ★ WITHOUT FLOODING? ★ WITHOUT DUST?



. . . Omega offers a complete line of equipment for Carbon and Carbon Slurries!!

Feed carbon as a slurry or dry . . . at any desired rate . . . economically, accurately, and dependably . . . with an Omega feeder designed for the specific application. Design features include provision for remote control, proportional pacing, recording and totalizing.



FOR FEEDING FINE DRY CARBON AT HIGH RATES

Omega Rotolock Feeder

Features positive, dust-free, non-flooding design. Omega variable speed drive permits adjustment over a 100 to 1 range. Three styles of rotors available. Cleanliness, automatic and proportional adaptability, recording, explosion-proof design, dependability . . . are additional features.

FOR FEEDING DRY CARBON IN SMALL PLANTS . . .

Omega Disc Feeders . . .

Accuracy . . . within ±3% to 5% by weight

Capacity . . . from 20 to 1700 cu in./hr.

Feed Range . . . up to 10 to 1 . . . any one of three change gears.

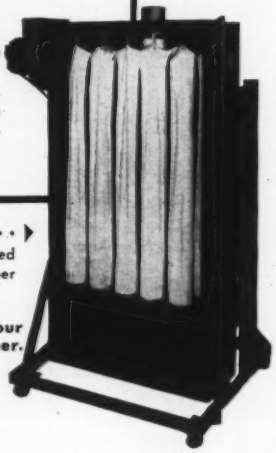
Omega Loss-In-Weight Feeders

Accuracy . . . within ±1% of set feed rate (by weight)

Capacity . . . up to 2000 lbs./hr.

Feed Range . . . as high as 100 to 1 if desired

Features . . . completely enclosed housing; bag-dumping hopper; Rotolock for positive, non-flood feeding.



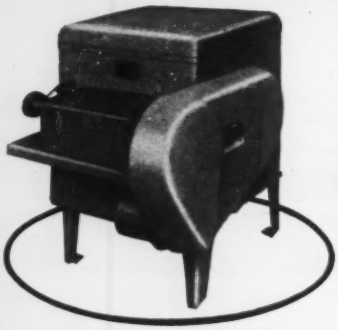
Omega Dust Collectors . . .

Self-contained . . . no long ducts or pipes required

Eliminate waste . . . collected dust falls back into hopper

Portable units also available

Ask about our patented bag-splitter, our wash-down dissolver, and bag loading hopper.



FOR FEEDING CARBON SLURRY . . .

Omega Rotodip Liquid Feeder

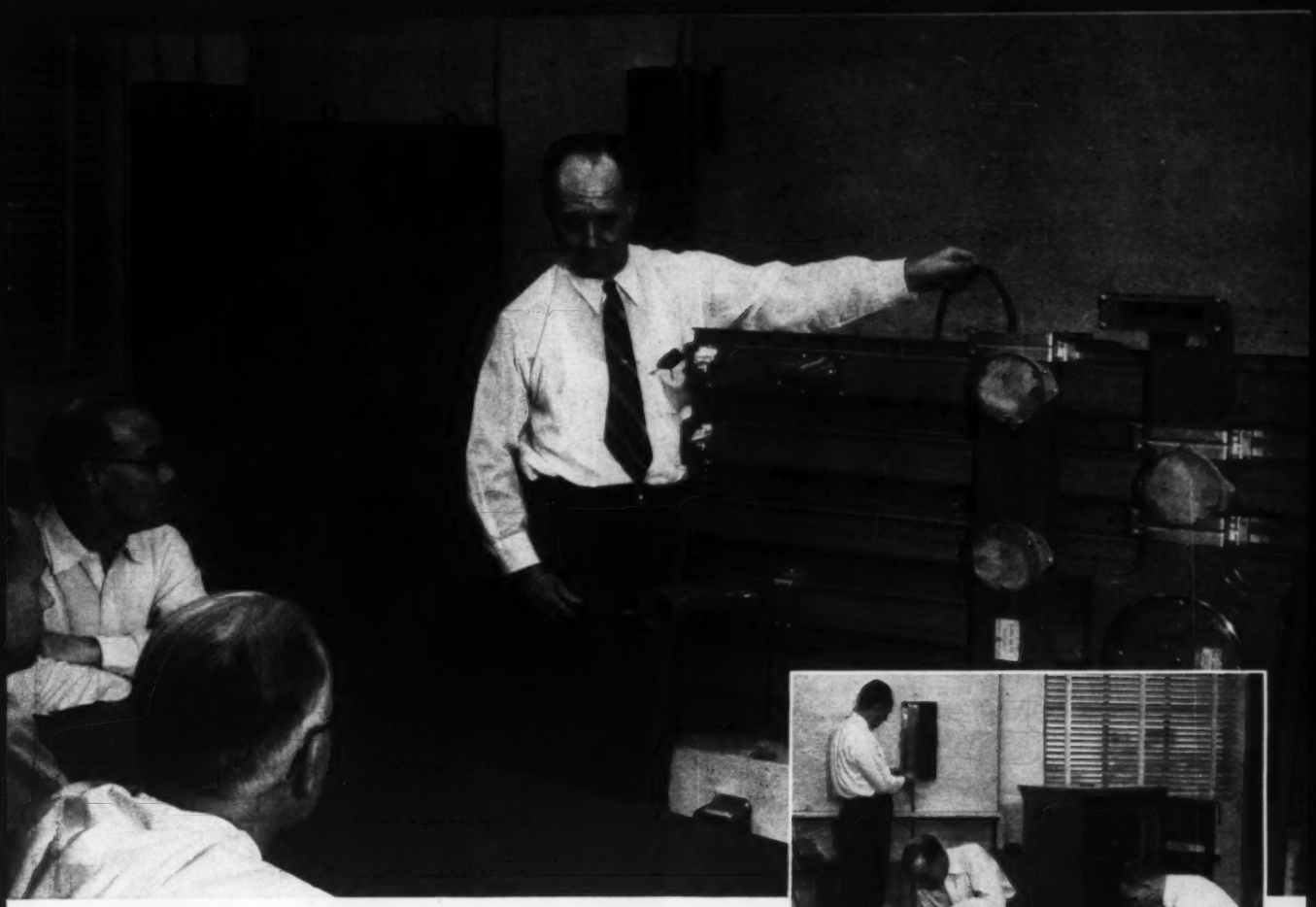
Accuracy . . . within ±1% of calibrated rate

Capacity . . . maximum rates up to 1800 gph

Feed Range . . . up to 100 to 1

Request recommendations . . . send complete details of your feeding requirements to . . . **Omega Machine Co., 360 Harris Ave., Providence 1, Rhode Island.**

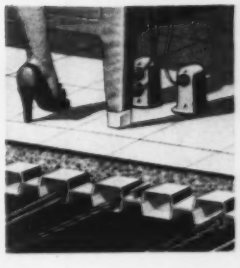
OMEGA MACHINE CO.
DIVISION OF
B-I-F INDUSTRIES
METERS · FEEDERS · CONTROLS



(Above) Demonstrating with a large sample section, Pennsylvania Bell Telephone Company School instructor explains to technician-students the basic principles of Q-Floor wiring. (Right) Members of the Q-Floor class become familiar with the product's advantages by wiring an actual installation in the classroom.

Q-Floor . . .
a Required Subject at this School

Every year, an estimated 1,600 Bell Telephone Company of Pennsylvania technicians attend a special school near Harrisburg, Pa. to learn the latest practice in line and equipment installation. Bell feels that cellular steel subflooring is so important that an entire classroom is devoted to the subject of Q-Floor wiring. Here the students learn by working with an actual Q-Floor installation that wires can be pulled and telephone or electrical outlets established often in a matter of minutes, and that every six-inch area of the entire floor is available for outlet use. This flexibility, so graphically pointed out to Bell students, plus substantial savings in construction time and money has influenced owners and architects all over America to provide for the future by building with Q-Floor today. Use the coupon to write for literature.



With Q-Floor performing its dual function of a structural subfloor and as a close-module underfloor wiring distribution system, building owners, designers and contractors benefit from construction speed, convenience and complete wiring flexibility.

Today's finest buildings are built with **Robertson**

Q-Floor

The STANDARD sub-floor construction for modern buildings

H. H. Robertson Company

2443 Farmers Bank Building, Pittsburgh 22, Pa.

In England—Robertson Thain Ltd., Ellesmere, Cheshire

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Please send 44-page Q-Floor Manual.

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COMPANY _____

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GUILD DRIVES RIGHT DOWNTOWN

with COBI PILES

From Supermarkets to Skyscrapers . . . Cobi Piles support hundreds of buildings throughout the United States.

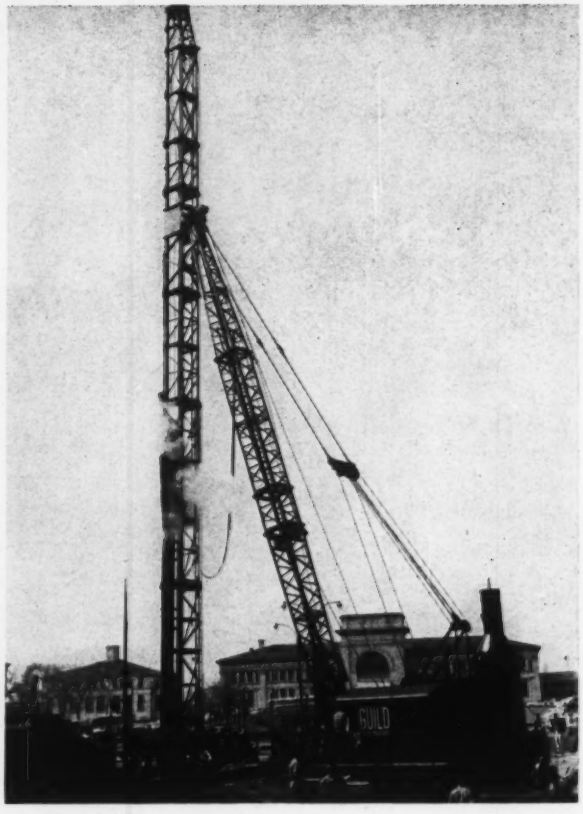
This Project: Howard Building

Location: In heart of Providence business district

General Contractor: George A. Fuller Co., Boston, Mass.

Piling Sub-Contr.: C. L. Guild Construction Co. Inc., East Providence, Rhode Island

Piling: Approx. 16,500 l.f. COBI cast-in-place piles



SPECIALISTS IN THE USE OF COBI PILES

GUILD DRIVES COBI PILES FOR THE NATION'S BRIDGES

Guild-driven Cobi Piles support highway structures of all types throughout the United States . . . over water and over land.

This Project: Branch Avenue Bridge

Location: Louisquisset Pike Extension (State of R. I.)

General Contractor: Campanella & Cardi, Hillsgrove, R. I.

Piling Sub-Contr.: C. L. Guild Construction Co. Inc., East Providence, Rhode Island.

Piling: Approx. 27,000 l.f. COBI cast-in-place piles

CALL C. L. GUILD FOR ESTIMATES ON ANY TYPE OF PILING JOB

C. L. GUILD CONSTRUCTION CO., INC.

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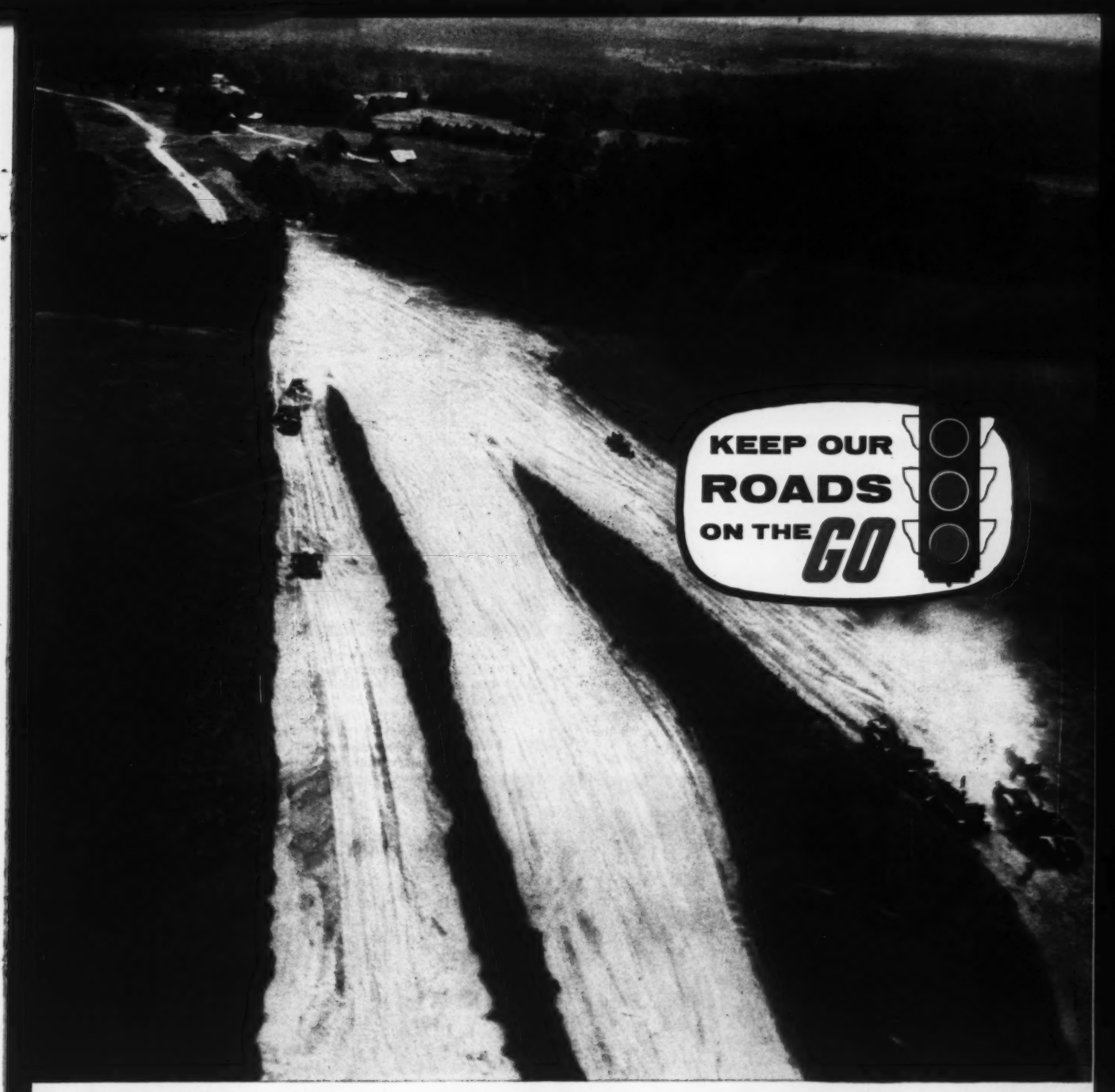
BOSTON, MASS. HOUSTON, TEXAS

SYRACUSE, NEW YORK NEW YORK, N. Y. KANSAS CITY, MO.



The Highway Program is "*on the go*" in the Carolinas . . .

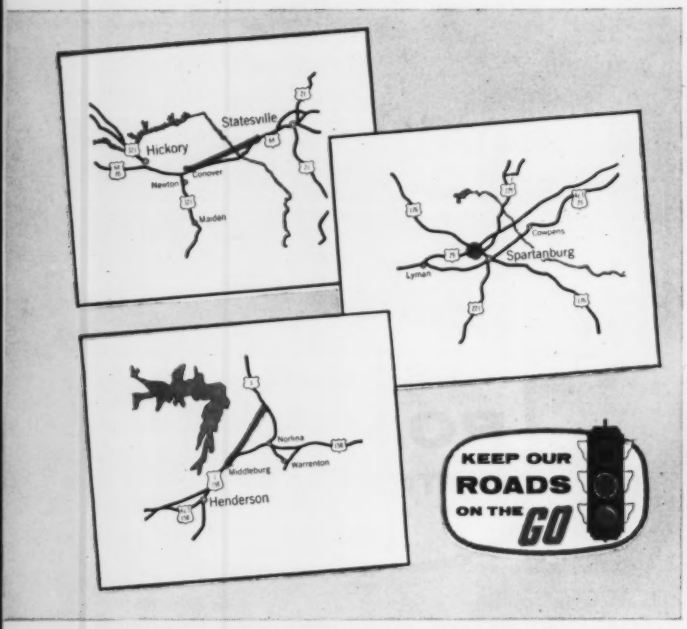
As of June 1st, North Carolina was already at work on 98 miles of the 714 miles of the Interstate System designated for the State. It thus ranked second only to Texas in the number of miles of highway under actual construction in the Federal Program.

In South Carolina, too, where a total of 769 miles of interstate highway will be constructed, work on U. S. Route 176, the first access road in the State, is well underway.

In North Carolina the program was developed under A. H. Graham and is now under the direction of W. F. Babcock, Director of Highways. In South Carolina, C. R. McMillan, Chief Highway Commissioner, is in charge.

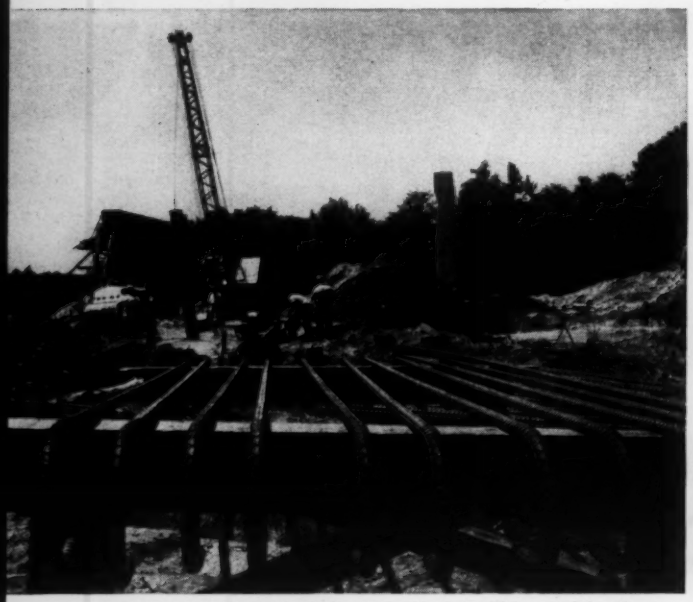
USS
TRADE MARK

...and products of United States

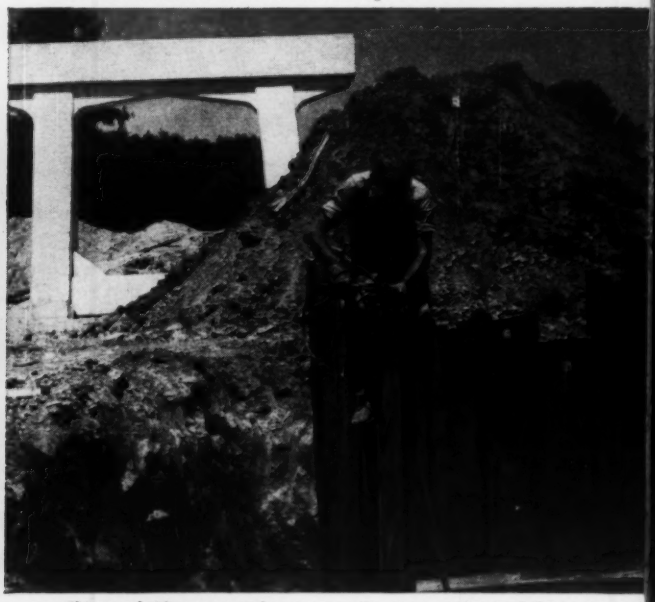


In North Carolina, work is being rapidly pushed ahead on U. S. Route 1 near Henderson and on U. S. Route 70 in the Hickory area. Thirteen bridges having a total footage of 4114 ft. are going up on these projects. In South Carolina, the 200-ft. overpass near Spartanburg that carries U. S. Route 176 over U. S. Route 29 is also progressing well with the grading and earth moving on the approaches nearly completed.

Construction of the Interstate System will involve the moving of an estimated 41 *billion* cu. yds. of earth. Your part in this job will be easier and more profitable if your shovels, scrapers, dozers, trucks and wagons have the "guts" to work at top capacity all year round. Built with USS High Strength Steels or USS "T-1" Constructional Alloy Steel—and fitted with American Tiger Brand Wire Rope where necessary—this equipment *will stand up* with least time out for maintenance and repairs.



An estimated total of 49 million tons of steel will be used for the Interstate System. More than one-quarter of this, 13 million tons, will go into bars for concrete reinforcement, much of it into USS Di-Lok Reinforcing Bars. Specifically designed to produce better reinforced concrete at lower cost, USS Di-Lok Bars feature a continuous, diamond-locking deformation that assures positive anchorage, reduces cracking to a minimum, makes shorter splices possible and frequently eliminates hooks.



Thirteen bridges are going up on the two sections of Interstate Highway now under construction in North Carolina. For your cofferdams, bridge abutments and retaining walls, USS Steel Sheet Piling and USS Steel Bearing Piles provide easily installed construction that is strong, rugged and lasting. Both are finished products, ready for use as shipped; installation is practically independent of weather conditions.

USS

Steel help *speed* road construction

A penny's difference in the cost of moving a yard of earth can be the margin between profit and loss on a road-building contract. That's why your earth movers must not only be big-capacity and fast-moving but must have the rugged stamina to stay on the job day after day. Super strength in parts that take a beating, high resistance to shock loading, fatigue and wear can be most economically obtained with USS High Strength Steels, and USS "T-1" Constructional Alloy Steel.

In bulldozers, scrapers and graders, the moldboard takes severe punishment. Here are concentrated the destructive forces of wear, abrasion and impact shock—all of which are amplified with every increase in equipment power and speed. For this reason, these steels have been continually improved. Now, with USS Abrasion-Resisting Steel, USS MAN-TEN and USS TRI-TEN high strength steels and USS "T-1" Steel available, shutdowns due to moldboard failure or premature wear-out can be practically eliminated.

These piers are typical of the bridge construction on the new section of U. S. Route 70 near Hickory, N. C. For such structures and for the concrete roadway as well, Atlas Duraplastic—an air-entraining portland cement—will give you more cohesive concrete that dumps, spreads and finishes easily. Atlas Duraplastic concrete has greater durability, and is fortified against freezing-thawing weather, yet it costs no more than regular cement.

268 feet of 60-inch steel pipe will be used in the culverts on the new 12.7 mile stretch of U. S. Route 1 running from Henderson, N. C. to the Virginia border. Combining low initial cost, fast and easy handling and installation, high strength and great durability, USS AmBridge Sectional Plate and USS Corrugated Steel Culverts offer you the most economical drainage structures available.

UNITED STATES STEEL

Only United States Steel can offer you such a complete line of products for Highway Construction

CONSTRUCTION STEELS
Structural steel shapes
Bearing piles, steel H-beam
Bearing piles, tubular steel
Sheet piling, steel

CONCRETE CONSTRUCTION PRODUCTS
Portland cements
Portland slag cements
Air-entraining Portland cements
High-Early Portland cements
White cements
Concrete reinforcing bars, straight and bent
Concrete reinforcing welded wire fabric
Wire for pre-stressed concrete construction
Concrete forms
Concrete form insulation
Road joints and dowels

BRIDGES
Bridge construction service
Bridge flooring, armored
Bridge flooring, concrete-filled grid
Bridge flooring, open grid
Bridge sidewalk flooring, T-grid
Grating, expanded metal
Bridge railing,
Expansion joints
Bridge nuts, pins, and tie-rods
Rivets
Eye-bars
Joists, open-web steel
Bolts, high strength steel
Rivet-bolts, high strength steel

SLAG
Air-cooled slag
Crushed slag
Screened slag
Granulated slag

DRAINAGE PRODUCTS
Sectional plate pipe and arches
Culvert sheets, corrugated steel
Culvert pipe
Culvert pipe, perforated
Flumes

FENCE and ACCESSORIES
Woven wire fence
Chain link fence
Cyclone fence
Barbed wire
Fence gates
Fence posts
Fence staples
Fence tools

SPECIAL STEELS and STEEL PRODUCTS FOR EQUIPMENT CONSTRUCTION
Abrasion-resisting steel
Constructional alloy steels
High strength, low-alloy steels
Grader blades
Wire and cable, electrical
Wire rope

BUILDINGS
Building construction service
Roofing and siding sheets, steel
Sheet steel, corrugated
Sheet steel, galvanized
Nails

CONSTRUCTION MATERIALS and EQUIPMENT
Caissons
Dredge hulls
Dredge pipe

SAFETY EQUIPMENT and HIGHWAY ACCESSORIES
Beam guard rail
Cable guard rail
Highway safety guard posts
Steel pipe light standards
Double-duty traffic markers
Pipe for radiant heating and snow-melting installations

The products and services indicated above are available from one or more of the United States Steel Divisions. USS offices are located in almost all major cities. Feel free to call on the office nearest you at any time—or write to:

UNITED STATES STEEL
525 William Penn Place, Room 5647
Pittsburgh 30, Pennsylvania

Divisions of United States Steel serving the highway market: American Bridge Division, Pittsburgh, Pa.
American Steel & Wire Division, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif.
Consolidated Western Steel Division, Los Angeles, Calif. • Cyclone Fence Department, Waukegan, Illinois
National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama
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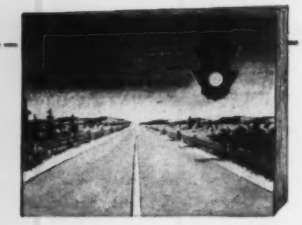


United States Steel
525 William Penn Place, Room 5647
Pittsburgh 30, Pennsylvania

Please send me a copy of your free catalog covering USS Products for Highway Construction, as soon as it comes off the press.

Name .....

Company .....

Title .....

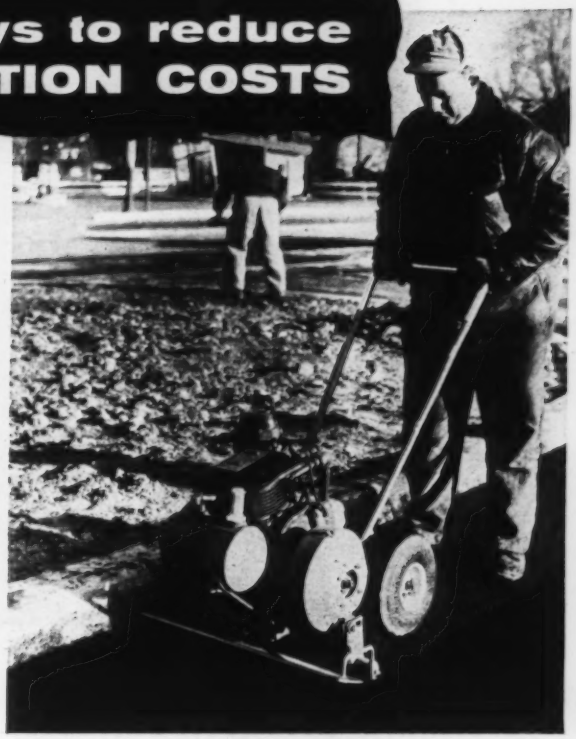
Address .....

City ..... Zone ..... State .....

UNITED STATES STEEL

USS TRADE MARK

2 sure ways to reduce COMPACTION COSTS



THE BARCO RAMMER

Put Barco Rammers on the job and watch the results. One of the biggest advantages they offer is ability to handle work in minimum time.

HIGH DEGREE COMPACTION — In test after test, Barco Rammers have demonstrated their ability to deliver 95% to 97.5% compaction (modified Proctor Method) — EASILY! EFFICIENTLY! ECONOMICALLY!

FOR TOUGH JOBS — The Barco Rammer is especially useful for compacting fill in restricted areas close to walls, culverts, and abutments — in trenches, ditches. ONLY the Barco Rammer can produce specified high degree compaction on lifts up to 20 inches.

ONE MAN OPERATION — On area tamping, one man can average 20 to 30 cubic yards of fill per hour. On trench backfill, using lifts up to 24", the rate for 18" trench is 360 to 600 feet per hour.

Ask for Catalog 621

THE BARCO VIBRA-TAMP

The new Barco VIBRA-TAMP is a proven tool — superior in design and performance — backed by leading equipment distributors representing Barco in all parts of the country.

VERSATILE PERFORMANCE — For vibratory compaction of granular base materials and tamping bituminous surfacing.

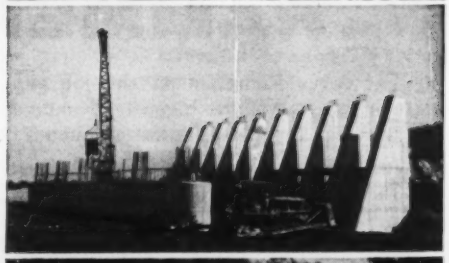
ECONOMICAL — to buy, operate, and maintain! No special tools required. Saves your bigger, costlier equipment. Tamp up to 750 sq. yds. per hour. A real work-horse on sand, gravel, soil, chippings!

EFFICIENT, DEPENDABLE — One man does the work of many with VIBRA-TAMP. Self-propelled. Operates in any weather. Works flush against curbs, foundations, and walls. Simple design and quality construction keep the machine on the job day in and day out. Moving parts fully enclosed. Handle adjustable to comfortable height.

Ask for Catalog 630

FOUNDED 1908
BARCO
PRODUCTS BACKED BY EXPERIENCE

BARCO MANUFACTURING CO. 6121 Hough St., Barrington, Ill.
BARCO RAMMER
for High Degree Soil Compaction
BARCO VIBRA-TAMP
for Granular Fill and Bituminous Surfacing



forming Bridges, Culverts, Piers?

UNI-FORM *PANELS*

Save LABOR, MATERIAL, TIME!

Simple mechanical assembly and pre-engineered techniques for handling virtually any forming condition make UNI-FORM Panels your best bet for fast, low cost forming. Successful contractors everywhere are using the UNI-FORM system to form bridges, overpasses, culverts, piers and abutments, because their experience has shown that UNI-FORM Panels give them the speed, flexibility and economy required to handle this complex type of forming at the lowest possible cost.

Let us prove our point. Send a set of plans for detailed forming specifications, recommendations and cost analysis. There's no obligation, of course.

P1501

UNIVERSAL FORM CLAMP CO.

Concrete Form Specialists Since 1912

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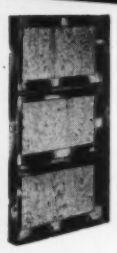
1401 Howell Mill Rd., N.W.

Here Are The Basic Elements:



2. UNI-FORM Tie

3. UNI-FORM Tie Key

1. Steel framed, plywood faced UNI-FORM Panel

this is the **TS-360**

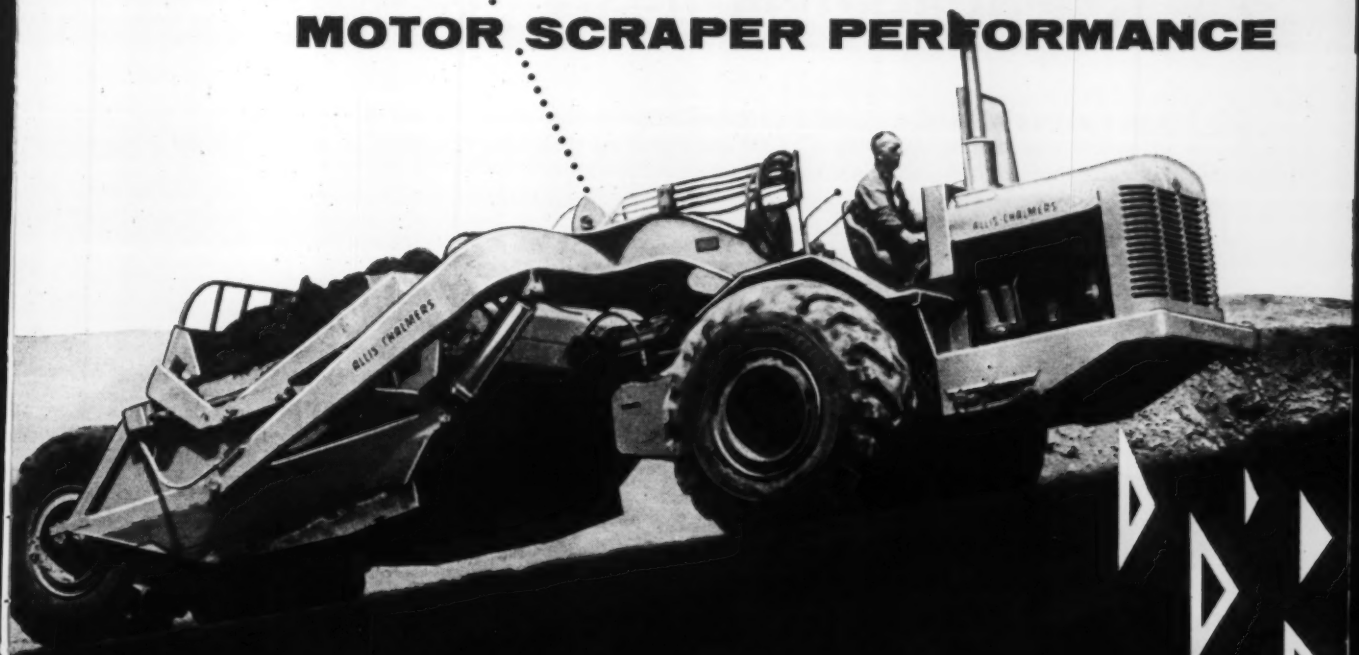
15 yd struck
20 yd heaped
280 horsepower

this is the **TS-260**

11 yd struck
14 yd heaped
200 horsepower

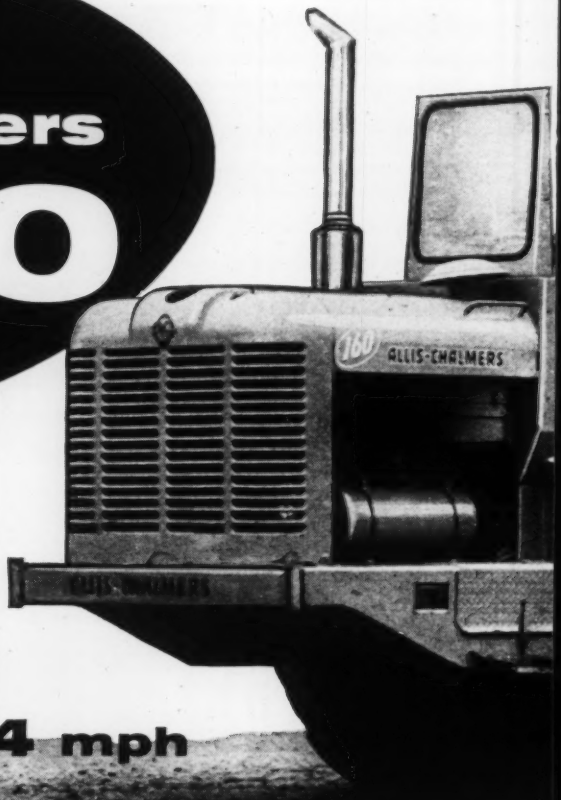
now...

ALLIS-CHALMERS BRINGS YOU ANOTHER NEW MEASURE OF MOTOR SCRAPER PERFORMANCE



the TS-160

NEW Allis-Chalmers TS-160



7 yd struck

9.5 yd heaped

155 horsepower

5 speeds to 25.4 mph

12-ton payload

Measure these advantages for

22 hp per struck yard—Big Allis-Chalmers supercharged diesel engine delivers extra lugging ability for tough pulls, fast loading. Versatile TS-160 can team up with big equipment or work alone on long- or short-haul construction jobs—handle a wide range of utility jobs, travel at speeds up to 25.4 mph.

Measure these features . . . Allis-Chalmers 516-cu-in. diesel engine—dependable power at all working speeds • Independent, constant live hydraulic power for steering and scraper operation • Low, wide bowl—8-ft, 1½-in. cutting edge . . . 3-piece, interchangeable cutting edges . . . double-acting hydraulic bowl lift jacks • Positive hydraulic ejection, high apron lift to full 7-ft, 1½-in. opening • Roomy operator's compartment, easy-to-reach controls, 24-volt direct electric starting, adjustable bucket-type seat, synchronized 4-wheel air brakes • Big push block for all types of pushers—positioned for in-line push • Full-circle visibility while loading, spreading and traveling . . . operating ease under all conditions • 17¾-in. minimum ground clearance in hauling position.

a wide range of construction jobs . . .

Turns non-stop in less than 25 ft with 90-degree hydraulic steering . . . easy maneuverability in narrow cuts, faster cycles without reversing in tight turn-arounds.

Moves quickly from job to job . . . when required, transport wheels are available to meet legal load limits for highway travel.

Allis-Chalmers, Construction Machinery Division
Milwaukee 1, Wisconsin

ALLIS-CHALMERS

Engineering in Action

GENTLEMEN: Have the Allis-Chalmers Construction Machinery dealer serving my area arrange a demonstration of the TS-160 motor scraper for me ☐.

Name_____

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Type of work_____

NEWS OF ENGINEERS

Richard H. Clough, formerly a member of the civil engineering faculty of the University of New Mexico, and more recently a partner with Lembke-Clough-King, Construction Co., Albuquerque, is returning to the university. Dr. Clough, now associate professor of civil engineering, is a specialist in soil structures.

T. Keith Legaré has retired as secretary of the South Carolina State Board of Engineering Examiners, after 35 years of continuous service. At a recent meeting of the Board, Mr. Legaré was elected vice-chairman and retained as a consultant. He will continue as executive secretary of the National Council of State Boards of Engineering Examiners, which office he has held for more than 33 years. The South Carolina Society of Professional Engineers presented Mr. Legaré with the first South Carolina "Engineer of the Year" award, and made him the first life member of the society.

T. Keith Legare

Floyd W. Hough announces his recent retirement as chief of the Geodetic Division Army Map Service, and the opening of a consulting service in geodesy and geodetic engineering in Washington, D. C.

Albert C. Kaestner Inc., New York City engineers and contractors, announce the removal of their offices to 331 Madison Avenue.

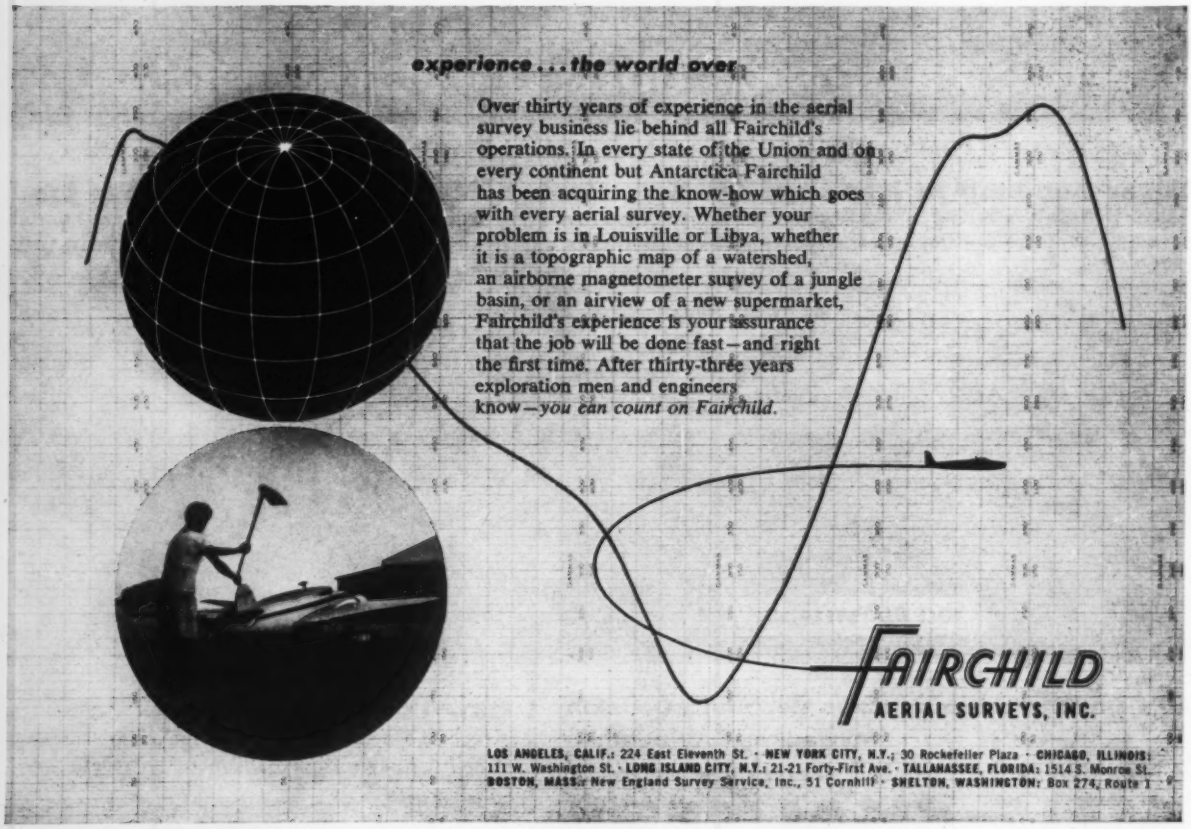
George F. Carney has been appointed West Coast sales representative of the Stressteel Corporation of Wilkes-Barre, Pa. Mr. Carney has been with the Truscon Steel Division of the Republic Steel Corporation for 27 years. He lives in Sausalito, Calif.

Leonard Bushnell recently opened an office for the practice of civil engineering at 206 Bank of America Building, San Jose, Calif.

Blucher A. Poole, director of environmental sanitation of the Indiana State Board of Health, took office as chairman of the Ohio River Valley Water Sanitation Commission on July 10. He brings to the post 26 years of experience acquired with the Indiana State Health Department. Recently Mr. Poole was expert adviser in sanitary engineering to the U. S. delegation at the 1957 World Health Organization meeting in Geneva.

Blucher A. Poole

S. C. Hamilton, district sales manager of the Houston (Tex.) Branch of the Chicago Bridge & Iron Company, has been made a vice president and general sales manager of the firm. He has been connected with the company since 1928. **K. W. Lange,** formerly with the San Francisco sales office, has been appointed Houston district sales manager. Mr. Lange joined CB&I in 1941.


experience . . . the world over
Over thirty years of experience in the aerial survey business lie behind all Fairchild's operations. In every state of the Union and on every continent but Antarctica Fairchild has been acquiring the know-how which goes with every aerial survey. Whether your problem is in Louisville or Libya, whether it is a topographic map of a watershed, an airborne magnetometer survey of a jungle basin, or an airview of a new supermarket, Fairchild's experience is your assurance that the job will be done fast—and right the first time. After thirty-three years exploration men and engineers know—you can count on Fairchild.
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LOS ANGELES, CALIF.: 224 East Eleventh St. · NEW YORK CITY, N.Y.: 30 Rockefeller Plaza · CHICAGO, ILLINOIS: 111 W. Washington St. · LONG ISLAND CITY, N.Y.: 21-21 Forty-First Ave. · TALLAHASSEE, FLORIDA: 1514 S. Monroe St. · BOSTON, MASS.: New England Survey Service, Inc., 51 Cornhill · SHELTON, WASHINGTON: Box 274, Route 1

H. F. Sykes Jr., Colonel, Corps of Engineers, and director at the Army Engineer Research and Development Laboratories at Fort Belvoir, Va., is retiring from the Army after 28 years' service as an officer. Prior to his appointment as director, Colonel Sykes served with the Corps' civil works and military construction units in both interior and overseas commands. He served on the staff of the Munitions Board in the Office of the Secretary of Defense; in the Office of the Chief of Engineers as chief of the research and development division; and as director of the Army War College.

Colonel Sykes

Horace O. Titus, former chief bridge designer for the Wyoming highway department at Cheyenne, has been named new chief design engineer of Gate City Steel, Inc., Boise, Idaho.

C. A. Budnik has joined Kaiser Engineers, of Oakland, Calif., as assistant manager of the Industrial Construction Division. Formerly Mr. Budnik was construction engineer with the Maxon Construction Co., Inc., of Dayton, Ohio.

E. D. Case, since 1946 president of the Pitometer Associates, New York City, became chairman of the board on July 1. **E. Shaw Cole,** who has been vice-president and chief engineer, became president, and he was succeeded as vice-president by **H. E. Beckwith. C. R. Bird** remains as vice-president in charge of the Chicago office. The newly initiated position of principal engineer will be filled jointly by **J. M. Shanley,** now in charge of the Houston office, and **W. D. Hudson,** currently assistant chief engineer in charge of the Atlanta office.

Lawrence E. Hall has joined the System Operations Department of the General Office of Puget Sound Power & Light Company, Bellevue, Wash. Until recently Mr. Hall was in charge of engineering studies for the Washington State Power Commission in Seattle.

Allen L. Sams, office engineer for the Illinois Central Railroad, Chicago, has been promoted to principal assistant engineer. Mr. Sams has been with the Illinois Central since 1941.

Joseph C. Nowell, Jr., has been appointed manager of engineering for the General Electric Company's Real Estate and Construction Operation, in a reorganization of the company's engineering and construction activities. Offices for the new division will be at 1 River Road, Schenectady, N. Y.

(Continued on page 32)

DURAJOINT PVC WATERSTOPS

TESTED . . . and proven BEST!

Test after test, made by various independent research organizations, conclusively prove that DURAJOINT Waterstops are the only waterstops available on which you can stake the safety of your design and reputation. The results of these tests plus the many other advantages offered by DURAJOINT Waterstops are concisely stated in our new Waterstop Manual No. 457. Check and mail the coupon below for your free copy . . . it will make an excellent addition to your waterstop file.

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Gentlemen:

☐ Please send me, without obligation, a copy of Manual No. 457.

☐ Have Representative call.

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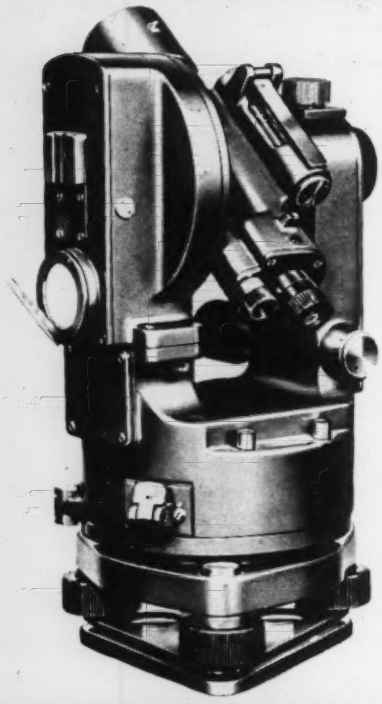
F/S MODEL 4149



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- **Horizontal circle reading direct to 30 seconds; vernier estimation to 10–15 seconds.**
  Vertical circle reading to 1 min.
- **25 X Telescope with 1.3 in. lens.**
- **Telescope Vial with mirror reader.**
- **Self-centering Vertical Axis.**
- **Horizontal motion with clutch-clamp and endless screw.**
- **Single-lever repetition control.**

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PRICE $820 INCLUDING TRIPOD

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Send for further information

FILOTECNICA SALMOIRAGHI INC.

41-14 24th Street
Long Island City 1, N. Y.

News of Engineers

(Continued from page 31)

K. S. Bawa, soils engineer with Gannett Fleming Corddry & Carpenter, Inc., Harrisburg, Pa., is representing his firm at the Fourth Conference of the International Conference on Soil Mechanics and Foundation Engineering, which is being held in London this summer.

Hugh M. Arnold has been appointed Lieutenant Governor of the Canal Zone and vice president of the Panama Canal Company. The incoming Lieutenant Governor is now completing a three-year assignment with the Canal organization as engineering and construction director. During World War II Colonel Arnold was engineer of the Western Pacific Base Command. After the war he was assigned to command of the Yuma (Ariz.) Test Branch of the Engineer Research and Development Laboratories, and later served as Executive Officer in the Civil Works Division of the Office of the Chief of Engineers. He was 1956 president of the Panama Section.

Colonel Arnold

John B. Benson, Jr., Covington County (Alabama) engineer, has been appointed to the Highway Cost Committee of the Highway Research Board with headquarters in Washington D. C. Mr. Benson is president of the National Association of County Engineers, and secretary of the Joint Highway Advisory Board of the Auburn Research Foundation.

Almon H. Fuller, professor of civil engineering at Iowa State College, was honored by his colleagues at a dinner recently. Dr. Fuller has served the college for 37 years as professor and department head.

G. E. Crist and **W. F. Tate** have been promoted to senior engineering positions in the engineering division at Humble Oil & Refining Company's Baytown (Tex.) refinery. Mr. Crist, a senior project engineer, is responsible for obtaining and editing justifications for all major construction at the refinery, and for studying special engineering problems. Mr. Tate, senior civil engineer, handles design work on various refinery facilities and process units, and coordinates overall design work on some jobs. He also reviews and coordinates the designs of consulting engineers.

Edward Hamric has been named assistant superintendent of the Pipeline department of Texas Gas Transmission Corp., Owensboro, Ky. Mr. Hamric joined the firm in 1948 as an engineer, following his graduation from the University of Mississippi.

Jay F. Krakauer, an engineer with the firm of Parsons, Brinckerhoff, Hall and Macdonald, New York City, has been elected to the Beta of New York Chapter of Phi Beta Kappa. Honorary and alumni memberships are based on distinction in letters, science or education. Dr. Krakauer graduated with honors from the N. Y. U. College of Engineering and received his masters and Ph.D. degrees from the Graduate School of Arts and Science. During a career as economist, engineer, city planner, and administrator, he has maintained an active interest in literature.

Stephenson B. Barnes has been chosen "Man of the Year" by leaders of the construction industry of Southern California. Mr. Barnes was presented an achievement award honoring him for both his professional and civic attainments. The new "man of the year" is a structural engineer who has designed the engineering features of many important buildings in Southern California. Mr. Barnes was chairman of the Construction Industries Committee for two years, and a member of the Board of Examiners and Appeals of the Los Angeles County Department of Building and Safety for sixteen years. He is consultant to the Los Angeles City Civil Service Commission, and the State Board of Architecture.

Frank J. Vassalotti, Lieutenant Colonel and Post Engineer for the Ascom Area Command in Korea, has assumed duties as the commanding officer of the 19th Engineer Battalion at Fort George G. Meade, Maryland. Colonel Vassalotti has been in the Corps of Engineers since 1940. During World War II he was Area Engineer of the Delta Area in Helicopolis, Egypt, where he was responsible for construction of a repair depot and a hospital.

C. S. Pillsbury, vice president and secretary of the Chicago Bridge and Iron Company, Chicago, has retired. His home is at 10020 S. Winchester Avenue, Chicago.

Henry J. Hoeffer, Brigadier General, U. S. Army, and division engineer for the South Atlantic Division of the Corps of Engineers at Atlanta, retired on July 31 after 26 years in the Corps. He has served in numerous troop, staff and school assignments, and during World War II commanded the 814 Aviation Engineer Battalion and the 21 Aviation Engineer Regiment. Prior to his assignment at Atlanta General Hoeffer served as Commanding Officer of the Yokohama Engineer Depot.

General Hoeffer

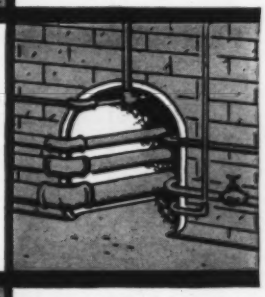
(Continued on page 108)

QUICK, LOW-COST ANSWER TO 4 PROBLEMS...

Flat-Base Pipe

PEDESTRIAN UNDERPASS

The practical way to safeguard the lives of adults and children. Especially valuable near schools and playgrounds. Also helps to maintain an even flow of street-level traffic.

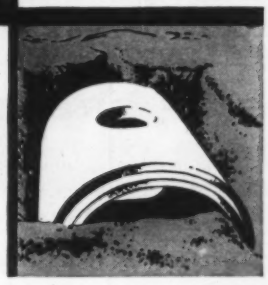


UTILITY GALLERY

Carries steam pipes, gas mains, electrical cables and telephone lines with ample room for workmen to make repairs. Flat-Base Pipe is also used for culverts and cattle passes.

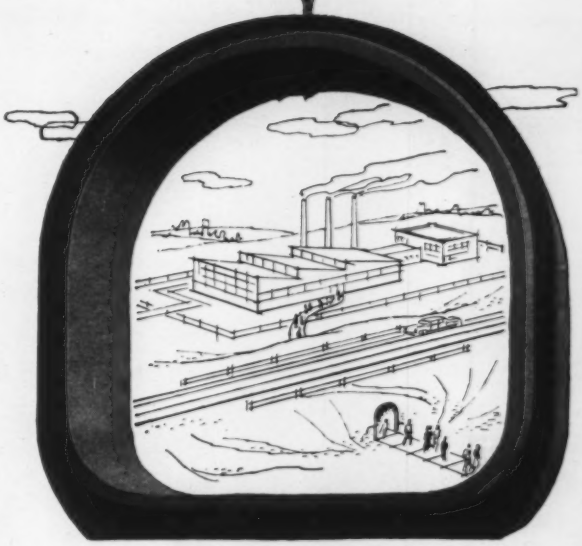
CATTLE PASS

Eliminate the hazards of road level crossings to lives and livestock with Flat-Base underpasses. Reinforced concrete Flat-Base Pipe can be jacked under railroads and highways without disturbing traffic.



UTILITY MANHOLE

Manholes for utility companies have often been built with Flat-Base Pipe in less than four hours. This eliminates needless traffic delay and reduces labor costs to a minimum.



Save as much as *30%* in the construction of pedestrian underpasses, culverts, utility galleries and manholes—with pre-cast Flat-Base Pipe. You can place and cover from 52 to 100 feet of Flat-Base Pipe in a single day. No forms to construct . . . no steel reinforcing to position . . . no concrete pouring. Can be jacked through old construction or laid in new fills. Joints are tongue and grooved and can be made watertight with rubber gaskets. Available now, in a wide variety of standard sizes.

Our technical staff will be pleased to assist you with your pipe problems

Write for free, illustrated folder on money-saving Flat-Base Pipe.

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION
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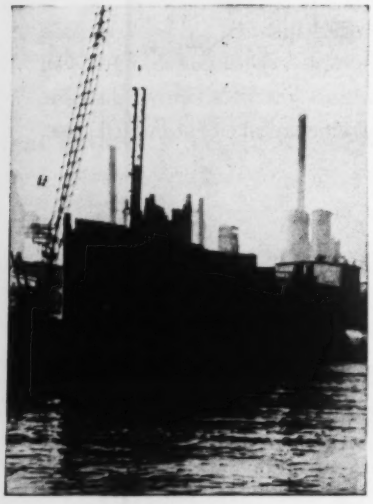
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

GREAT LAKES INDUSTRIAL CANAL DEEPENED TO ACCOMMODATE VESSELS OF GREATER DRAFT



The St. Lawrence Seaway will have an enormous impact on Great Lakes ports. Channels will be dredged deeper and docks rebuilt to handle the larger capacity ships that will eventually sail 2300 miles into the North American heartland.

The Seaway, expected to be completed in 1959, will add more than 8000 miles of new coastline to the United States and Canada. Much of this inland waterway is already navigable, and only dredging and deepening will be necessary to meet the Seaway's 27-ft channel specifications.

At Buffalo, the ship canal shown above was deepened from 23 ft to 29 ft. To accomplish this, a new steel-piling dock front had to be constructed, extending the walls down to the new canal bottom. Various types of dock wall construction were used, employing many thousands of tons of Bethlehem steel Sheet and H-Piling. The docks, which serve the plant for receiving raw materials and shipping finished steel products, have a length of nearly 10,000 ft.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

IMAGINE THAT!

The BALANCED Impeller may be trimmed to suit other heads and capacities -- yet REQUIRES NO SEPARATE COUNTERBALANCE.

- UNSURPASSED FOR HANDLING LONG STRINGY SOLIDS
- IDEAL FOR ELEVATING SEWAGE — PUMPING SLUDGE — HANDLING HEAVY SETTLEABLE SOLIDS, EFFLUENT AND OTHER WASTES
- TROUBLE-FREE PERFORMANCE — CONVENIENCE and LASTING ECONOMY
- DISCHARGE MAY BE TURNED TO ANY POSITION — ACCESSIBLE for CLEANING
- SMOOTH, QUIET OPERATION

PATENT PENDING

AURORA
NON-CLOG HORIZONTAL & VERTICAL
MONO-VANE
SINGLE PASSAGE IMPELLER
PUMPS

The exclusive new Mono-Vane impeller represents a major advance in the technique of non-clog pumping. This unique impeller can be trimmed to various diameters—REQUIRES NO COUNTERBALANCE because it is in dynamic and hydraulic balance — and affords a wide range of operation by merely trimming the impeller for each head and capacity requirement.

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AURORA Always PUMPS

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THE NEW YORK AIR BRAKE COMPANY
57 LOUCKS STREET • AURORA • ILLINOIS
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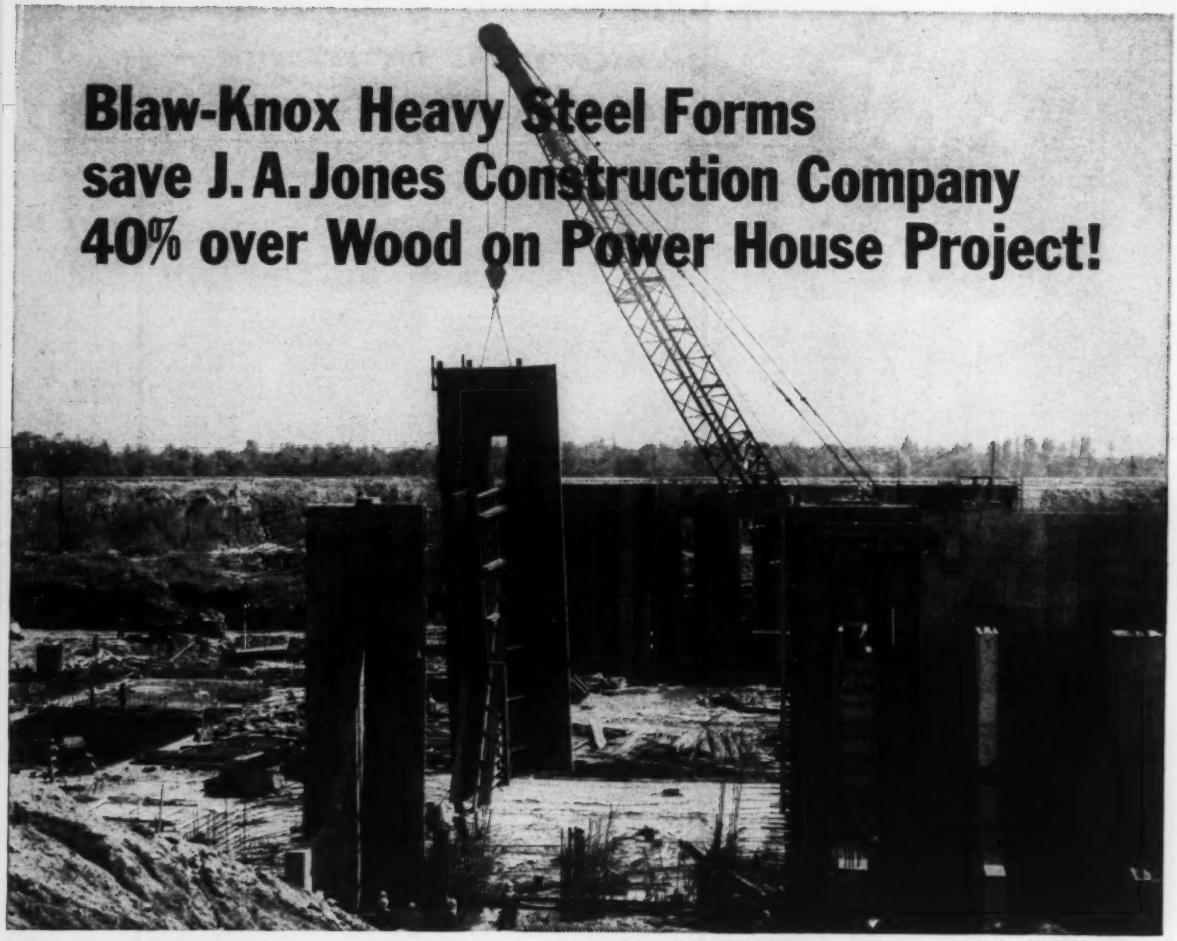
Blaw-Knox Heavy Steel Forms save J. A. Jones Construction Company 40% over Wood on Power House Project!



Backwall and counterfort form being placed. Handling time is cut to the bone by special form design. Form at right is ready for stripping and re-setting at new location.

Down along the banks of McKellar Lake at Memphis, one of the world's largest Steam Generating Stations is under construction. The J. A. Jones Construction Company, builder of the huge concrete substructure is using custom-built Blaw-Knox Heavy Steel Forms on a retaining wall that is 1,684 feet long and 41 feet high. They also are using Blaw-Knox Heavy forms for water intake, circulating and discharge tunnels.

Experience with more than 700 feet of wall shows that re-use of two sets of Blaw-Knox Steel Forms has actually saved 40% over the use of wood. Beyond this too, are the indirect advantages—safety, labor cost, uniformity of construction and salvage.

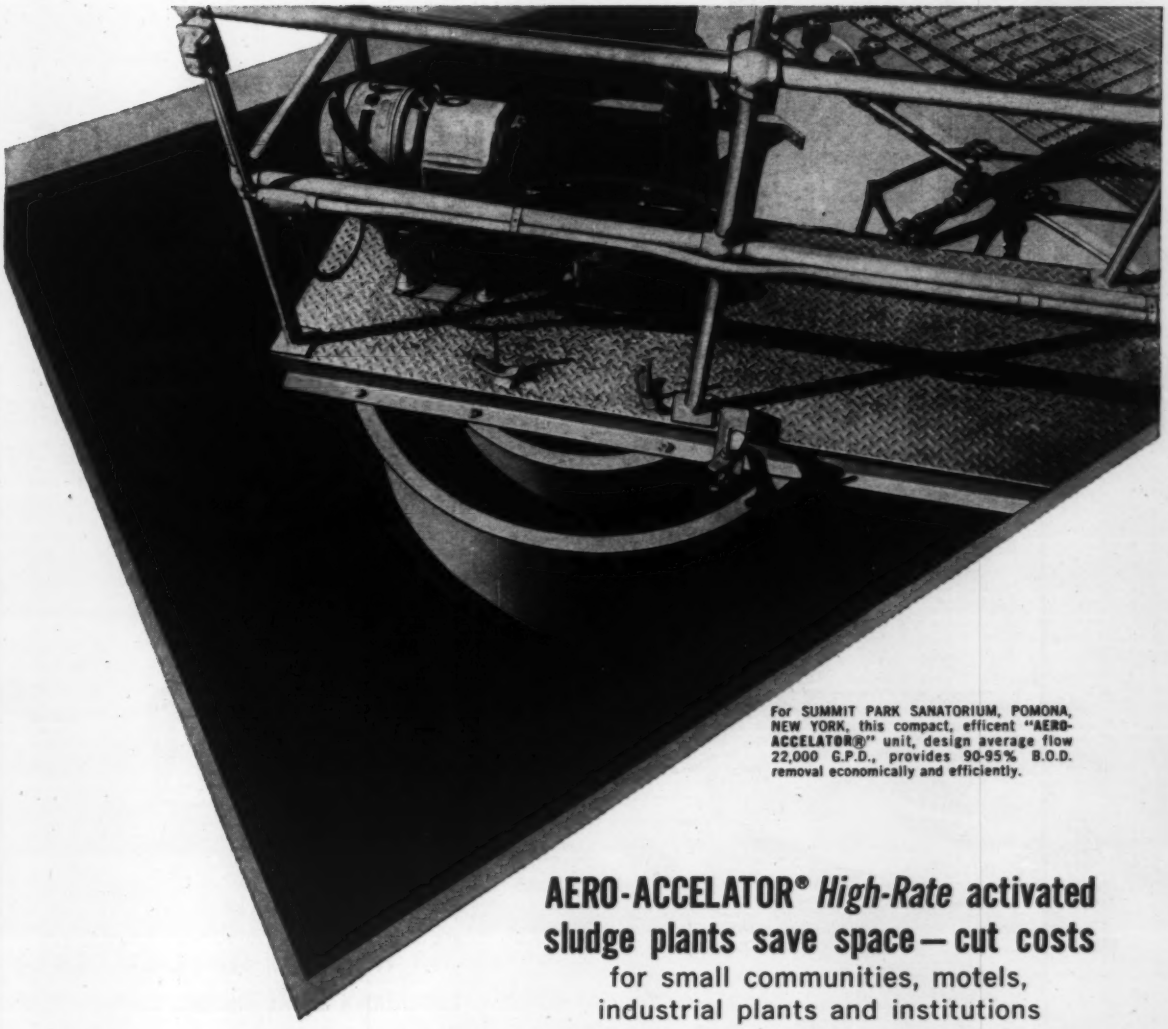
Advantages of custom-built Blaw-Knox Heavy Steel Forms have been proven on many construction projects of world wide interest. Where there is a concreting problem, the speed, flexibility, and salvageability of Blaw-Knox Steel Forms makes them the number one construction tool. They're backed by more than 40 years of experience on wide range of big projects.

Put the Blaw-Knox Steel Forms Consultation Service to work for you, whether your job is a dam, tunnel, sewer, or bridge. You'll get fast, simplified planning, custom-built forms tailored to the exact requirements of your project.

BLAW-KNOX

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Steel Forms Department, Pittsburgh 38, Pa. • Phone STerling 1-2700



For SUMMIT PARK SANATORIUM, POMONA, NEW YORK, this compact, efficent "AERO-ACCELATOR®" unit, design average flow 22,000 G.P.D., provides 90-95% B.O.D. removal economically and efficiently.

AERO-ACCELATOR® *High-Rate* activated sludge plants save space—cut costs

for small communities, motels, industrial plants and institutions

"AERO-ACCELATOR" activated sludge plants provide improved, complete treatment in less than half the time required by ordinary plants. As a result they can be installed in much less space and at greatly reduced cost, without sacrificing efficiency. Here are typical performance figures from the Summit Park installation—

			B.O.D.			Suspended Solids		
			ppm		%	ppm		%
Date	Test Period	Ave. Flow gpm	Raw Sewage	Effl.	Removal	Raw Sewage	Effl.	Removal
9-30-54	7 AM-2 PM	20	264	9.2	96.5	117	7.7	93.4
10-25-54	8 AM-3 PM	25	321	24.0	92.5	301	16.6	94.5
10-30-54	8 AM-12 N	15	325	21.0	93.6	274	15.7	94.3
11-16-54	8 AM-3 PM	20	271	20.5	92.4	268	21.8	91.9
3- 4-55	7 AM-3 PM	20	169	14.0	91.7	125	11.0	91.2

Custom-designed units for all requirements

This type of installation is ideal for small and medium requirements and is also available for large municipal needs.

If you are faced with a pollution problem INFILCO equipment will afford you substantial savings in space, in costs of construction and installation, and in expense of operation. It will pay you to investigate. Write today for "AERO-ACCELATOR" activated sludge plant Bulletin No. 6510.

Inquiries and samples are invited on all problems in the treatment of water, sewage and wastes.

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Six 40,000-gal. Horton Waterspheres welcome turnpike travelers to food and motor supplies along the 236 mile route at: Topeka, Emporia, Lawrence, El Dorado, Mulfield-Green, and Wellington, Kansas.

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Six Horton Waterspheres® beckon pike travelers, from a distance, to service areas spaced at 45 mile intervals along the route. Their pleasing symmetry typifies the careful blending of beauty, safety and utility which has marked the commission's planning for this project.

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. . . . . Am-Soc Briefs

▶▶ A positive program of professional activities was developed for the coming year at the recent meeting of the Department of Conditions of Practice in Cincinnati (story on page 88) Discussion ranged widely — a national registration policy for ASCE, more efficient utilization of the nation's classroom space, advertising by engineers, encouraging Junior Member contributions to ''Civil Engineering'' — to mention a few of the topics. . . . Incidentally, the Society is creating a Task Committee on Professional Development, headed by Clarence H. Ax and made up of representatives from the Committees on Engineering Education, Junior Members, and Student Chapters. This group will study the professional attitude of students and young members of the profession.

▶▶ Engineers have been selected for the new United Engineering Center: Seelye, Stevenson, Value & Knecht will be the structural engineers, and Jaros, Baum & Bolles the mechanical engineers. . . . More about the recently acquired site on impressive United Nations Plaza and an aerial view of it in the Society News section.

▶▶ This month you will notice changes in the Society's Engineering Salary Index, which is being kept up to date on a quarterly basis. . . . For contrast with the salary set-up forty years ago, take a look at a 1917 ASCE survey (page 90) when starting salaries ranged from a low of $600 to a high of $2,500 a year and the average salary was $1,200 a year.

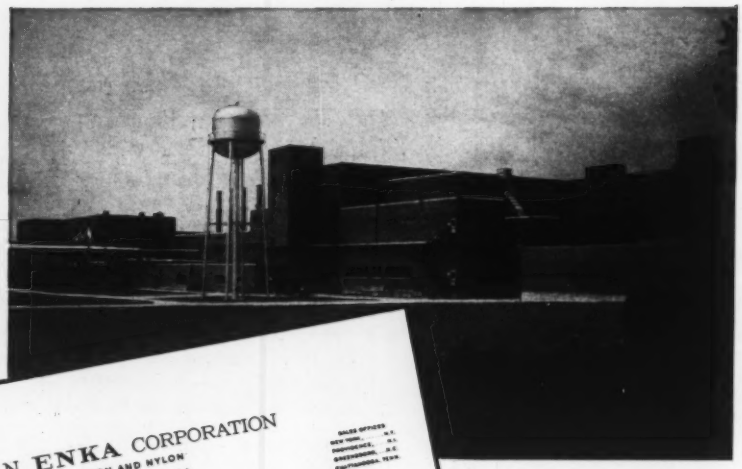
▶▶ The exciting papers on arch-dam construction, which turned out to be one of the highlights of the Knoxville Convention last summer, are now available in a new book that sells for $5.00 (coupon to make ordering easier on page 148).

▶▶ Are you an underprivileged member? It is your right to receive the publications of the two Technical Divisions, in which you may register. Some 11,000 members are getting only half the publications due them because they are registered in only one Division. However, it is the 11,000 members who are not enrolled in any Division whom the Society is especially eager to serve. . . . if you haven't received a Technical Journal or other Division communication in the past two months, fill out and mail the coupon on page 157.

▶▶ Congratulations are in order for the Texas Section, where an enterprising committee has placed 3,000 applications in the hands of qualified engineers who do not belong to ASCE. . . . Have you obtained a new member for ASCE? Are you yourself in the highest membership grade for which you are qualified?

The Customer's View:

SATISFACTION.... BUILT OF STEEL



Staple fibre plant at American Enka Corp's. Lowland, Tenn., facility. H. K. Ferguson Co., Inc., New York, engineer.

AMERICAN ENKA CORPORATION
PRODUCER OF RAYON AND NYLON
ENKA, NORTH CAROLINA
TELEPHONE: WOODS 7-1311

October 26, 1956

Bristol Steel & Iron Works, Inc.
Bristol, Virginia-Tennessee

Attention: Mr. J. G. Tilley

Dear Mr. Tilley:

We wish to thank you and members of Bristol Steel & Iron Works for the excellent job done under your structural steel contract for our Lowland Staple Plant. Mr. Gaston, Project Engineer, and Mr. Rice, Resident Building Engineer, were particularly impressed with your engineering and fabricating shops, and feel they should be congratulated on an excellent job of design and fabrication as there were very few misfits in the field. They also feel that Mr. Settles, Erection Superintendent, should be especially congratulated for his co-operation and efforts in maintaining a tight schedule under adverse weather conditions.

The co-operation and friendly relationships, as well as excellence of job, are certainly appreciated by American Enka Corporation.

Very truly yours,

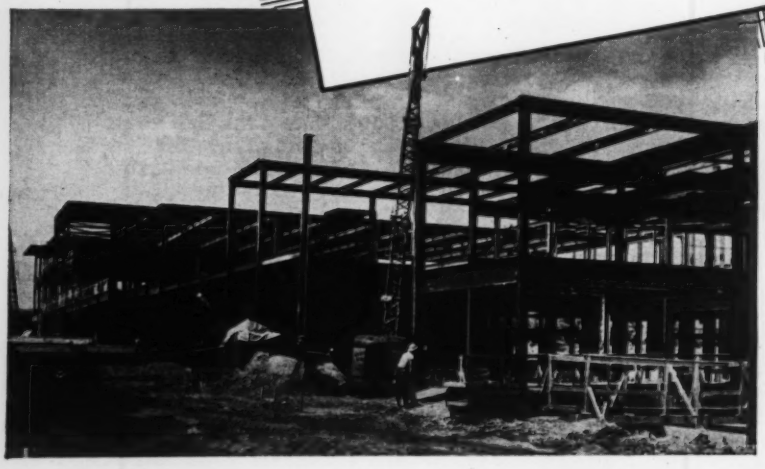
AMERICAN ENKA CORPORATION

A. L. Jackson

A. L. Jackson
Director of Engineering

WMG:EB
cc: Mr. W. F. P. Coxe
Mr. W. M. Gaston
Mr. C. W. Rice

Bristol Steel fabricated and erected more than 3200 tons of steel for this expansion.



BRISTOL STEEL AND IRON WORKS, Inc.

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Since 1908

AISC

Bristol, Virginia

do you know that

California leads the nation in new construction contracts? On the basis of awards for the first half of the year, California—with $2,185,000,000 in contracts—alone accounted for 13 percent of the national total. It ranked first in heavy engineering and residential building, and second in non-residential building. New York was next to California, with a total of $1,683,000,000 in contracts for the period, and Illinois ranked third with $1,165,000,000 in contracts. The three together were responsible for nearly one-third of all the nation's construction contracts. Source of these figures is the F. W. Dodge Corporation's mid-year review of construction.

• • •

Venice is slowly sinking into the sea? In 300 years, experts predict, the proud city on the Adriatic will be largely under water. A combination of the increasing sea level throughout the world and the lowering of the bottom of the lagoon on which Venice is located is held responsible. According to the Water Magistrate's Office —set up more than five centuries ago—Venice is sinking at the rate of 15 in. a century. While sealing off the lagoon from the open sea would keep the doomed city from being inundated, it would kill it in a more ignominious way by turning the lagoon into a vast stagnant marsh.

• • •

Funds have been allocated to continue the national highway program through 1959? To insure uninterrupted progress in carrying out the new national highway program, annual funds are being allocated eleven months ahead of the usual government schedule of apportionments. For highway improvements in the 1959 fiscal year beginning July 1, 1958, Secretary of Commerce Weeks has just apportioned the states $2,875,000,000. The first allocation, under the highway legislation enacted in 1956, came to $1,125,000,000; the second, for the fiscal year 1958, was $2,550,000,000.

• • •

Mexico City's tallest building was not damaged in the earthquake of July 28? The 43-story Latino Americana Tower—supported on button-bottom concrete piles driven to point bearing on a hard sand strata 105 ft under the old lake bed on which the city is built—came through the repeated shocks intact. Not even glass windows were broken. Though ten big buildings fell or were so badly damaged that they have been condemned, buildings resting on deep concrete piles or on massive concrete mats survived undamaged. The Mexico City earthquake was one of high intensity, being estimated at 7 on the Mercalli scale of 12 which indicates total destruction.

• • •

The new federal water pollution control program is completing its first year? Grants totaling $37,942,326 were made to 466 municipalities to help them build sewage treatment plants during the recently completed initial year of the new federal water pollution control program. To this amount communities added $128,856,364, bringing the total cost of projects to $166,798,690. The average federal grant was about $85,000 per community, and the population of the average community served about 22,300.

• • •

Evaporation lowers the level of Lake Mead more than seven feet a year? On a daily basis the loss is in the neighborhood of 635,000,000 gal. In 1955 the loss was 699,000 acre-ft, and in 1954 it was 796,000 acre-ft.

• • •

The outlook for iron ore is good? Estimates of our iron-ore resources are currently put at about 75 billion tons. This estimate of the U.S. Geological Survey represents an increase of more than 25 billion long tons since its last summary of iron-ore resources published in 1955. The increase is due partly to new exploration and partly to the inclusion of additional low-grade material in the Lake Superior region.

• • •

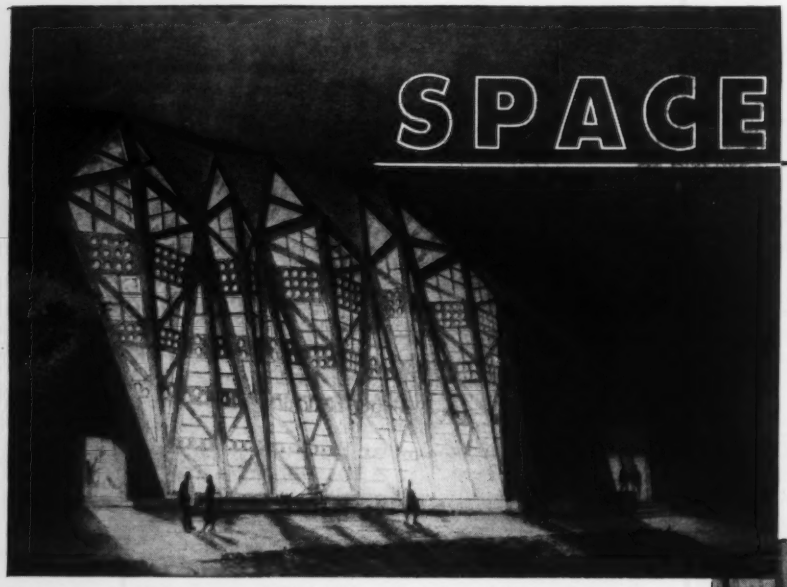
Turnpike travel is breaking its own safety records? A drastic reduction of 54.3 percent in Pennsylvania Turnpike fatalities is reported for the first six months of 1957 in comparison with the same period last year, with 16 persons killed this year and 35 fatalities last year. Also on the credit side is a reduction in total injuries suffered—430 injured in 1957 accidents as opposed to a toll of 528 last year. These achievements were chalked up despite an increase of 20.8 percent in vehicles using the turnpike and an increase of 16.7 percent in mileage driven.

• • •

There is a new device for simulating the flight path of space vehicles? Of great possible value in this geophysical year is a satellite-tracking device, invented by engineers at the Fort Belvoir Research and Development Laboratories and called "Panatrack." The apparatus consists essentially of a projector inside a globe, which may be positioned manually or automatically to show on a screen or wall a view of the terrain over which the space vehicle passes. Rate and direction of motion can be adjusted as desired. In satellite tracking, the drive motors would be controlled by signals transmitted from the moving object and processed through ground stations.

• • •

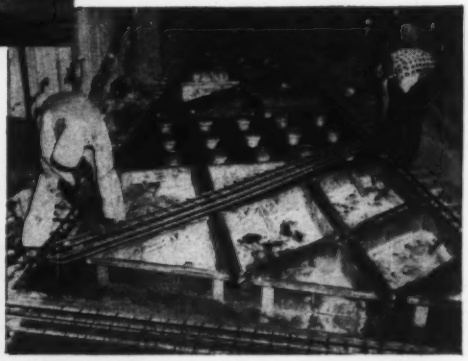
New York City's construction boom goes on apace? Everywhere the old and dilapidated is being replaced with the up-to-date. Skyscrapers, pier projects, and airport installations are among the spectacular new metropolitan area projects which will be featured in the forthcoming (October) Annual Convention issue.



SPACE enclosed 'archi-structurally' makes this new church stand alone

Rendering shows giant abstract Biblical fish or whale form of church. Chancel, not shown, is at observer's left. Church is 234' long, 54' at its widest, and seats 670.

Cathedral-Like Vastness Achieved by Wrapping Space in Pre-Cast Concrete



152 precast elements were used—80 triangles some perforated, others solid, and 72 solid quadrilateral panels—maximum sizes for panels 36 ft. x 10 ft.; for triangles 35 ft. on longest measure—maximum weights: for panels 10 tons; for triangles 5 tons.

● Construction of the new First Presbyterian Church of Stamford, Conn. in which space is literally wrapped in precast concrete wall and roof elements that are self-supporting, without columns, beams or lintels can perhaps best be described as 'archi-structural' — the shell or frame being both structural and enclosing.

Reinforced concrete wall and roof elements, factory-fabricated to closest tolerances, were trucked to the job site. Panel bottoms were fastened to the footing, slanted panels being supported by false-work until roof panels were lowered into position, making the integrated wall and roof self-supporting. An eight-inch band of concrete connects the panels, resulting in a monolithic structure of great strength and rigidity.

The glass of inch thick amber, emerald and sapphire pieces was made in France from the templates of the triangular sections sent there for that purpose.

Dependable 'Incor'* high early strength, used throughout this job, makes possible assembly-line precision in casting . . . faster form re-use, maximum production with minimum form investment.

*Reg. U.S. Pat. Off.

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CIVIL ENGINEERING

Scholarships for highway engineers

JOHN R. DIETZ, M. ASCE, Vice President, Gannett Fleming Corddry & Carpenter, Inc., Harrisburg, Pa.

Perhaps the most important effect the new federal highway program will have on the civil engineer can be described by the one word "opportunity." This opportunity will not be limited to individual employment. There will be a collective opportunity for the entire profession to prove that the engineer is ready, willing, and able to do the job, whether he represents a public agency or a private consultant. The latter is in an especially opportune position, in that he can also prove that private enterprise can contribute its share to the job, with sound and economical design, and with full consideration of the client's purse.

For many years, before the enactment of the present Federal Aid Highway Act, there was a noticeable tendency, on the part of some of our contemporaries, to look down their professional noses at the highway engineer. Today there is evidence of a change in this thinking. One need only glance at the "help wanted" columns to find nationally famous specialists in other fields sending out almost frantic appeals for highway engineers.

As in all other types of engineering, personnel poses a problem which will probably get worse before any improvement appears. Personnel is lacking not only in numbers but in training. A recent special issue of a large metropolitan newspaper carried 36 pages of ads for engineers. These ads probably cost $50,000 and could have provided fifty $1,000 scholarships, making available for the near future that many more engineers. It is doubtful whether all the firms together got fifty men. In fact, for each man they obtained, they probably lost one to another firm. This all emphasizes the fact that to get more engineers we must train them.

Assume we are short 10,000 engineering graduates yearly. At $5,000 per graduate for an engineering scholarship, the annual cost would be $50,000,000. I suspect the annual cost of advertising for technical personnel throughout the country approaches or exceeds this amount. If so, we are paying for sufficient personnel whether we get it or not.

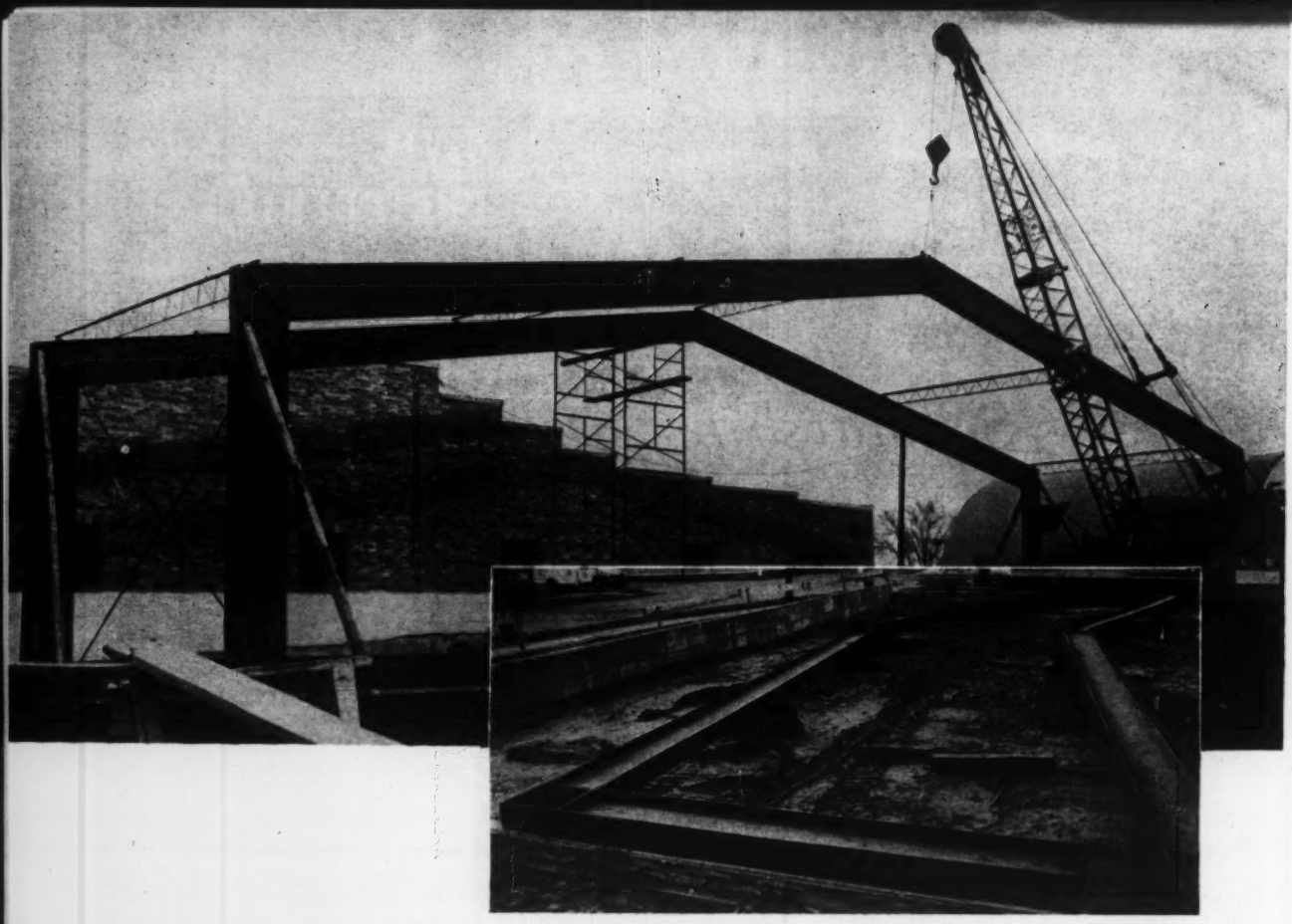
Firms like International Business Machines and United Aircraft Corporation are to be congratulated on their progress along these lines. In February, International Business Machines announced an annual scholarship fund of $250,000 for 50 four-year scholarships, one quarter of them to go to children of their own employees. United Aircraft Corporation has invested well over a million dollars in scholarships in the past three years. In one instance this company bought six acres adjacent to a campus, erected and equipped a modern college building and then donated it to the college so that the college could properly train the men the company was sending there on scholarships!

In a field with such a manpower shortage, no young man can be blamed for assuming that salaries must be in a fantastic bracket. Since the Federal Aid Highway Act became law, many engineering firms have been faced with demands for general salary increases. The Act seems to have been a signal, touching off a huge job-shopping tour on the part of young engineers and a hysterical ad campaign by employers. This situation could easily lead to carelessness in screening applicants and a constant turnover in personnel. Obviously this will contribute nothing to ease the shortage but will aid in edging upwards the inflationary spiral. Engineers cannot fight inflation alone, and no claim is made that salary increases should be avoided, but there should be at least a reasonable relationship between wage increases and productivity improvement.

Hand in hand with the personnel shortage goes the need to improve methods and increase individual productivity. Highway Departments and consulting engineers are taking advantage of newly developed methods and procedures, including wider use of photogrammetry and electronic computers.

The national government, spurred on by the needs of the nation, has insisted on the new highway program, and the various state governments, caught in a manpower squeeze, have turned to the consultants for help. If this help is properly given it will be the greatest single step yet taken by the engineer in his quest for professional recognition.

(This article has been abstracted from the address by Mr. Dietz before a recent meeting of the Central Pennsylvania Branch of ASCE's Philadelphia Section.)



Plastic design of

EDWARD R. ESTES, Jr.
A.M. ASCE

Research Engineer
American Institute of Steel Construction
New York, N. Y.

The plastically designed rigid frame looks the same as hundreds of steel rigid frames in existence throughout the country yet it represents one of the most significant improvements in the design of steel structures in recent years. By using plastic design, the structural engineer is able to save both design time and steel while assuring himself of a realistic factor of safety when compared to elastic design methods.

Engineers in England have been using plastic design methods for several years, based on research conducted in that country. American engineers have waited for the results of research conducted in this country for the past ten years. It is now seen that plastic design techniques can be safely applied to statically indeterminate structures such as continuous beams and single- and multiple-span rigid frames.

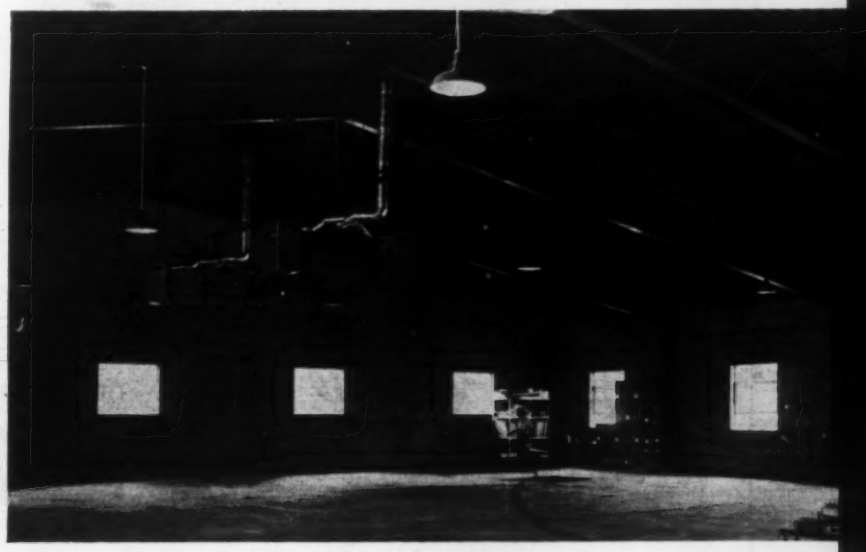
Elastic analysis of an indeterminate structure can be lengthy; therefore formulas and charts are in common use which reduce the time involved. The methods of plastic analysis are considerably simpler than those of elastic analysis, but comparable formulas and charts have been developed. See Fig. 1. It is in the design of the less typical and more highly redundant structures, for which formulas are not available and analytical methods must be employed, that the relative simplicity of plastic design becomes strikingly evident.

Good example of plastic design

The Dalton Company warehouse in Sioux Falls, S. Dak., is an excellent example of the application of plastic design to a typical single-span rigid frame. This design is based on recommended procedures and specifications incorporated in *Plastic Design in Steel*, a manual soon to be published by the American Institute of Steel Construction. Background for this manual will be found in a joint ASCE-Welding Research Council committee report to be published shortly. Methods of analysis

Frames of Dalton Company warehouse are hoisted into position following field welding at site. Frames laid out for assembly are seen in inset. Only three working days were required for field welding and erection. Detail of lateral bracing is shown in Fig. 4.

Completed warehouse is ready for use.



Frames have pinned bases.

warehouse saves steel

have been presented in the proceedings of ASCE and AISC.

Frames of the Dalton Company warehouse span 88 ft from center to center of columns and are spaced 18 ft 6 in. on centers, as seen in Fig. 2. A dead load of 12 psf and a snow load of 30 psf together total a working load on the frame of 42 psf. Then

$$42 \times 18.5 = 777 \text{ lb per ft}$$
$$\text{Est. weight of frame} = \underline{100 \text{ lb per ft}}$$
$$877 \text{ lb per ft}$$

Use $w = 0.9$ kips per ft

To be assured of a factor of safety at least as great as that of a simple beam designed for a 20,000-psi working stress with a minimum guaranteed yield of 33,000 psi, this working load is multiplied by a load factor of 1.88 to obtain w_u, the ultimate load used in the design formulas.

$$w_u = 1.88 \times 0.9 = 1.69 \text{ kips per ft}$$

First the required value for the plastic moment, M_p, is computed without allowance for any wind load. This is quickly determined from the formula for frames with pinned bases subjected to vertical loading only, found in Fig. 1.

The value of Q, the ratio of roof rise to column height, is found to be 0.533. Then the value of α, ratio of distance between column and point of possible plastic moment in rafter to span length, is found.

$$\alpha = \frac{1}{0.533}\left(\sqrt{1.533} - 1\right) = 0.446$$

The required M_p is

$$M_p = \left(\frac{1.69\ (88)^2}{4}\right)\left(\frac{0.446 \times 0.544}{1.238}\right)$$
$$= 653 \text{ ft-kips}$$

For purposes of comparison, it is now necessary to compute the required value of M_p taking into account the wind loading of 20 psf. The uniformly distributed wind loading is replaced by a concentrated load at the eave which produces the same overturning moment about the base of the windward column. Then:

$$T = 20 \times 18.5 \times \frac{23}{15} \times \frac{23}{2} = 6{,}520 \text{ lb}$$

Use $T = 6.5$ kips

Since present elastic design specifications permit a one-third increase in allowable stress when gravity loading is combined with wind, the load factor is reduced by one-quarter in plastic design, to 1.41.

$$w_u = 1.41 \times 0.9 = 1.27 \text{ kips per ft}$$
$$T_u = 1.41 \times 6.5 = 9.2 \text{ kips}$$

The relationship between column height, span, wind, and gravity loading is introduced into the formulas for α and M_p in the form of the coefficient C.

$$C = \frac{2 \times 9.2 \times 15}{1.27\ (88)^2} = 0.028$$

$$\alpha = \frac{1}{0.533}\left(\sqrt{1.533 \times 0.9851} - 1\right)$$
$$= 0.430$$

MOMENTS AND REACTIONS AT ULTIMATE LOAD

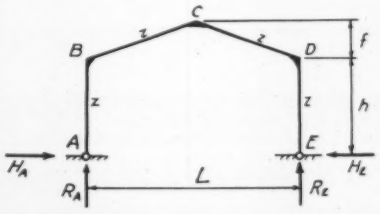
$Q = \frac{f}{h}$

$C = \frac{2 T_u h}{W_u L}$

$W_u = wL$

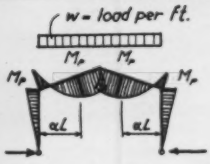
$T_u h$ = moment of total horizontal loading T_u taken about point A.

Z = plastic modulus (assumed constant throughout frame).



UNIFORMLY DISTRIBUTED VERTICAL LOAD ALONE

PINNED COLUMN BASES



$R_A = R_E = \frac{wL}{2}$

$H_A = H_E = \frac{M_p}{h}$

$M_p = \frac{wL^2}{16}$

$\alpha = \frac{1}{2}$

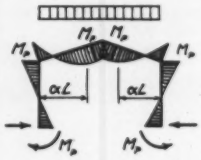
---- when Q=0

$M_p = \frac{wL^2}{4}\left[\frac{\alpha(1-\alpha)}{\sqrt{1+Q}}\right]$

$\alpha = \frac{1}{Q}\left[\sqrt{1+Q} - 1\right]$

when Q>0

FIXED COLUMN BASES



$R_A = R_E = \frac{wL}{2}$

$H_A = H_E = \frac{2M_p}{h}$

$M_p = \frac{wL^2}{16}$

$\alpha = \frac{1}{2}$

---- when Q=0

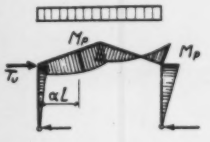
$M_p = \frac{wL^2}{4}\left[\frac{\alpha(1-\alpha)}{\sqrt{1+2Q}}\right]$

$\alpha = \frac{1}{2Q}\left[\sqrt{1+2Q} - 1\right]$

when Q>0

UNIFORMLY DISTRIBUTED VERTICAL LOAD COMBINED WITH HORIZONTAL LOADING

PINNED COLUMN BASES



$R_A = \frac{wL}{2} - \frac{T_u h}{L}$

$R_E = \frac{wL}{2} + \frac{T_u h}{L}$

$H_A = T_u - H_E$

$H_E = \frac{M_p}{h}$

WHEN $C > \frac{1}{1+Q}$ (POSSIBLE CONDITION):

$M_p = \frac{wL^2}{4} \cdot C$

$\alpha = 0$

... Plastic hinges at B and D only

WHEN $C < \frac{1}{1+Q}$ (USUAL CONDITION):

$M_p = \frac{wL^2}{16}(1+C)^2$

$\alpha = \frac{1-C}{2}$

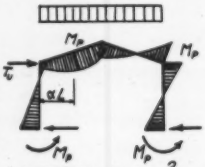
----- when Q=0

$M_p = \frac{wL^2}{4}\left[\frac{(1-\alpha)(C+\alpha)}{\sqrt{(1+Q)(1-QC)}}\right]$

$\alpha = \frac{1}{Q}\left[\sqrt{(1+Q)(1-QC)} - 1\right]$

... when Q>0

FIXED COLUMN BASES



$R_A = \frac{wL}{2} - \frac{T_u h}{L} + \frac{2M_p}{L}$

$R_E = \frac{wL}{2} + \frac{T_u h}{L} - \frac{2M_p}{L}$

$H_A = T_u - H_E$

$H_E = \frac{2M_p}{h}$

WHEN $C > \frac{2}{1+2Q}$ (POSSIBLE CONDITION):

$M_p = \frac{wL^2}{8} \cdot C$

$\alpha = 0$

Plastic hinges at A, B, D and E only

WHEN $C < \frac{2}{1+2Q}$ (USUAL CONDITION):

$M_p = \frac{wL^2}{4}\left[3 + C - 2\sqrt{2+C}\right]$ *

$\alpha = 2 - \sqrt{2+C}$ *

when Q=0

$M_p = \frac{wL^2}{4}\left[\frac{(1-\alpha)(C+\alpha)}{\sqrt{2+C-4CQ^2+4Q}}\right]$ *

$\alpha = \frac{1}{1-2Q}\left[2 - \sqrt{2+C-4CQ^2+4Q}\right]$ *

when Q>0

* When C < 0.25 using these formulas, corresponding value for M_p may be less than that computed for vertical load alone and latter will govern.

FIG. 1

$$M_p = \left(\frac{1.27\ (88)^2}{4}\right)\left(\frac{0.570 \times 0.458}{1.229}\right)$$

$$= 523 \text{ ft-kips (taking wind into account)}$$

It is evident that the case without wind governed the design. Thus a 24 WF 94 is found to be more than adequate since it furnishes a plastic moment of 696 ft-kips.

The horizontal and vertical reactions are readily calculated from equilibrium equations:

$$H_A = H_B = 653/15 = 43.5 \text{ kips}$$

$$R_A = R_B = \frac{1.69 \times 88}{2} = 74.4 \text{ kips} = P$$

$$\frac{P}{P_y} = \frac{74.4}{33 \times 27.63} = 0.082 < 0.15$$

As long as the ratio between the computed axial column force and the force required to produce yielding (area times yield stress) does not exceed 0.15, the full plastic moment of the column is available, as is the case here. This ratio is usually low in single-story rigid frames since the stress due to bending is predominant. As calculated above, this ratio is only 0.082, and no reduction in the available M_p is required. Since P/P_y did not exceed 15 percent, it was not necessary to apply the rule for computing the modified plastic moment. (A suitable rule for this computation has been developed.)

The connection at the knee must be strong enough to develop the plastic moment of the connected members. In the detail shown in Fig. 3, note that the stiffening plates have approximately the same cross section as the flanges. This type of connection has been shown to be more than adequate in tests conducted at Lehigh University.

Lateral bracing provided

Adequate lateral bracing must be provided just as in elastic design. Plastic design is based on the theory that at ultimate load, that is, 1.88 times the working load, a system of plastic hinges will form in the structure. At the locations of these potential hinges it is recommended that lateral support be provided for the tension flange as well as for the compression flange. This support is provided by the detail shown in Fig. 4. This tension-flange bracing is omitted at points where there is no possibility of the elastic limit being exceeded at ultimate load.

The elastic design requirements of this frame, based on an allowable stress of 20,000 psi, would be satisfied by a 30 WF 108 for both girder and columns without haunching the knees. The plastic design resulted in savings of approximately 13 percent in structural steel.

A comparison with an elastic design with haunches was not made. The use of haunches in both plastic and elastic design would result in steel savings. Carried to an extreme, however, a very slender beam, used as a result of deep haunches, would exhibit excessive deflection along with maximum weight saving. Furthermore, as compared with the design selected, the savings in steel would probably be offset by the cost of fabrication.

While the designer using plastic analysis is not interested in the values of actual stresses occurring in the structure, since the working load is based on a fraction of the maximum load which the structure in question is capable of supporting, the question occasionally is asked, "What is the maximum stress at working load?" In this particular frame the computed elastic stress at the knee due to the uniformly distributed load of 900 lb per lin ft is 24,600 psi.

Although deflections do not generally affect the design of a well proportioned frame of this type, the calculations are no different at working loads than they would be for an elastic design, since the stresses are below the elastic limit. Under the action of the vertical loading, the deflection at the center would be approximately 2½ in., and the horizontal movement of the knee would be less than ½ in. Deflections of a frame elastically designed with haunches could be more than twice as much.

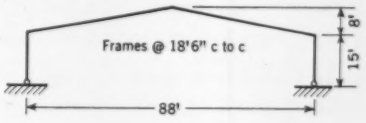
Field erection rapid

Field erection was accomplished in a relatively short time. In a week from the last day of shop fabrication the frames were in position, ready to receive the roofing. Of this time, two days were spent hauling the half frames by truck to the site, and Saturday and Sunday accounted for two days. Thus only three days of working time were actually required for field welding and erection.

Welding in the field was necessary at the crown, where the only field splice was located, and in the tie rods which were used to resist the horizontal thrust at the column bases. At the crown the web and flanges were scarfed, as shown in the detail in Fig. 3, to permit a 100-percent field weld providing full continuity. After the two halves were joined, the frames were tilted into an upright position.

Architects for the Dalton Company were Hugill, Blatherwick, Fritzel and Kroeger. The general contractor was the Sioux Falls Construction Company. Hassenstein Steel Company fabricated the structural steel.

FIG. 2. Frames of Dalton Company warehouse in Sioux Falls, S. Dak., were designed by plastic method.



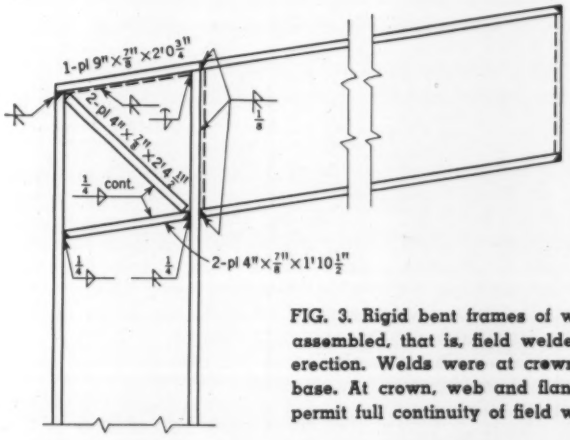


FIG. 3. Rigid bent frames of warehouse were fully assembled, that is, field welded, on ground before erection. Welds were at crown and in tie rods at base. At crown, web and flanges were scarfed to permit full continuity of field weld.

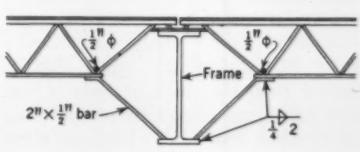
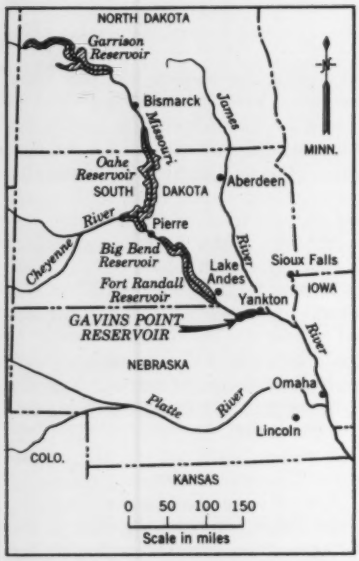
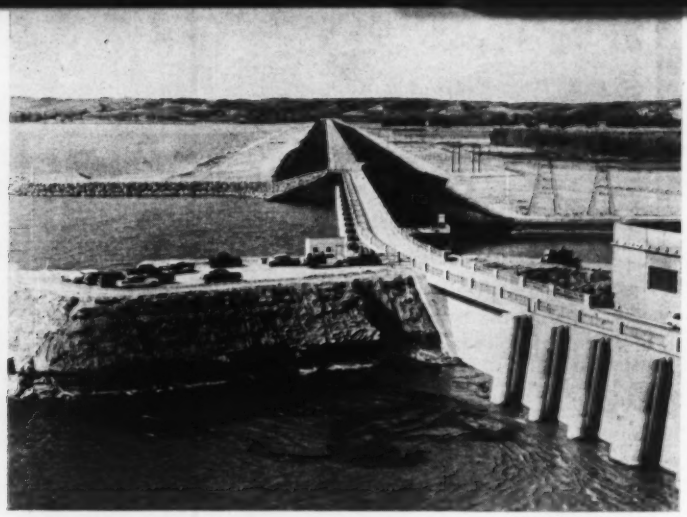


FIG. 4. Lateral bracing is provided for both tension and compression flanges of main frames, at locations of potential hinges.

FIG. 1. Gavins Point Dam, near Yankton, S. Dak., includes embankment containing 11,000,000 cu yd of Niobrara chalk, found in quantity in this area.





Large block of Niobrara chalk, left in its natural state, separates flow to spillway and powerhouse at Gavins Point Dam.

Chalk used as construction

Niobrara chalk, a soft bedrock formation, was used for embankment and for protection against wash at Gavins Point Dam near Yankton, S. D. (Fig. 1). Some 11,000,000 cu yd of this material, generally considered unsuitable for structural work, had to be removed from the spillway and powerhouse areas. Desirable fill materials were not available nearby.

Tests on similar materials at Fort Randall Dam showed that a spike-toothed roller, followed by a standard tamper roller, could produce a satisfactory embankment at a substantial saving in cost. Actual operation gave better results than had been anticipated.

Niobrara chalk occurs widely east of the Rocky Mountains. It is found from Canada to Texas and northeastern New Mexico, and eastward from Colorado, Wyoming, and southeastern Montana through the Dakotas to southern Minnesota. It is exposed as chalk bluffs along the Missouri River from below Yankton to above Chamberlain, S. Dak. The thickness of the formation varies from 500 ft in southwestern Nebraska to 150 ft at Fort Randall and 180 ft at Gavins Point.

The formation is a lead gray, argillaceous (clayey) chalk and chalky shale of sedimentary origin derived chiefly from the shells or tests of marine organisms deposited on the floor of the last great inland sea to cover this area. It occurs in well defined strata that are nearly horizontal and vary from a few inches to several feet in thickness. Fresh exposures of chalk are dark gray in color but weather to a tan or buff. The dry weight varies from 80 to 115 lb per cu ft.

Although the chalk appears to be a relatively soft rock in natural outcrops, it withstands natural forces of weathering without rapid deterioration. Freshly exposed chalk is medium hard, but if moist fresh-cut chalk is exposed to freezing it spalls very readily. However, freshly exposed chalk which is allowed to dry and season for several summer months spalls only slightly on freezing.

As shown by the profile in Fig. 2, the excavation for both the powerhouse and the spillway cuts entirely through the Niobrara chalk formation and into a Carlile shale formation. This excavation made necessary the removal of 11,000,000 cu yd of Niobrara chalk, 500,000 cu yd of Carlile shale, and 2,000,000 cu yd of glacial overburden.

Test embankment built of chalk

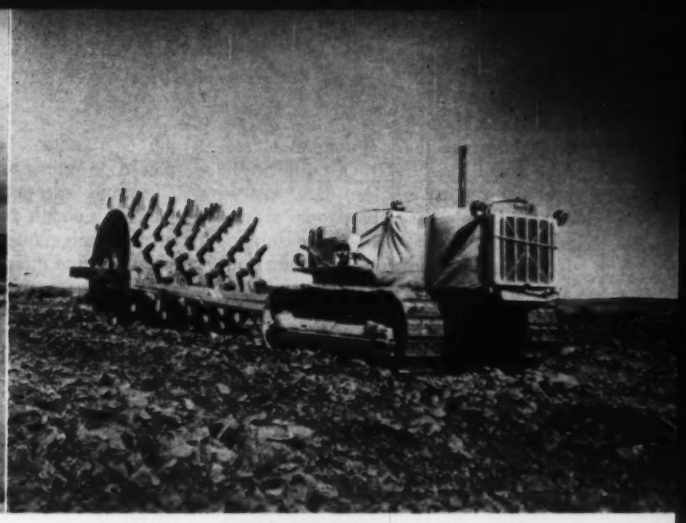
Considerable compaction data on the use of chalk as a fill material was obtained from a test embankment at the Fort Randall project. About 15,000 cu yd of Niobrara chalk were blasted, picked up by shovel, and trucked to the test area. Eleven layers of embankment were spread in three lanes over the test area. The first three layers were placed in 18-in. loose lifts; the remaining eight were spread in 8-in. loose lifts. The amount of compaction and the moisture treatment were varied for each lane of the several lifts. A special spike-tooth roller was used to break up the chalk before rolling with a standard tamper-type roller.

This special roller was 8 ft in diameter and 10 ft long, with 156 spikes 18 in. long. The spikes were designed with a chisel edge and were face hardened. The weight of this roller was 30,000 lb empty and 60,000 lb filled. It gave best results when two-thirds full.

Results of the compaction tests indicated that additional breakdown and compaction of the chalk was obtained up to six passes of either type of roller. Above the sixth pass, the amount of additional compaction obtained decreased sharply. Results of the various tests concerning moisture treatment indicated that the addition of water is an aid to the compacting action of the rollers. It was also observed that the chalk became rather brittle after drying for 48 hours, so that less effort was required to break it down.

From results at this test embankment, it was decided that a feasible method for compacting the chalk into a dense embankment would be to:

Marion walking dragline puts 8 cu yd of chalk into bottom-dump Euclid for haul to embankment.



Typical equipment for breaking up large pieces of chalk in uncompacted-fill area is 45,000 to 60,000-lb spike-tooth roller.

material at Gavins Point Dam

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1. Spread the material in 12-in. loose lifts.
2. Roll it with four passes of a properly designed spike-tooth roller.
3. Add moisture.
4. Compact it with four passes of a tamper-type roller.

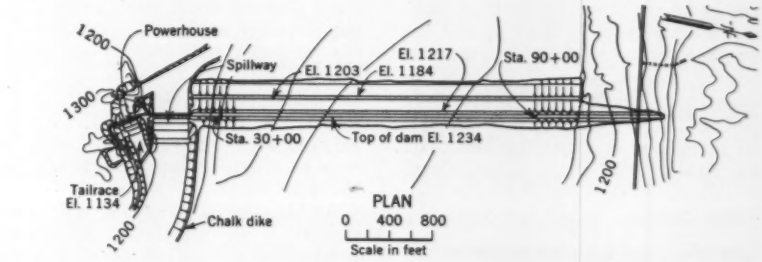
The test embankment was shown to be impervious by simple seepage tests in open pits about 4 ft square and 4 ft deep. The test consisted of filling a pit with water and observing the amount of drop in a 24-hour period.

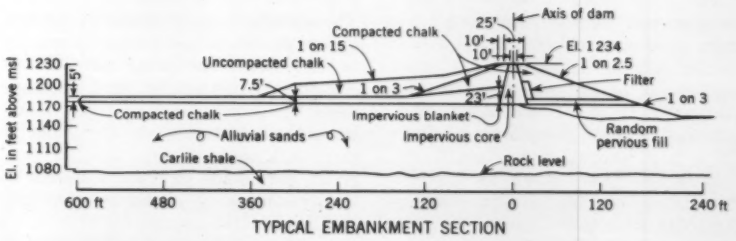
Tests made on samples from the test embankment indicated a dry density of 78 lb per cu ft and a moisture content of 34 percent.

Embankment section includes chalk

A typical embankment section is shown in Fig. 2. The embankment was constructed principally of two types of material—impervious earth fill and chalk. A conventional center core was used and was extended upstream in the form of a blanket made up of two sections, each 300 ft long, consisting of impervious rolled fill material and compacted chalk. Shell sections of compacted chalk were placed both upstream and downstream of the central impervious core. A graded filter 8 ft thick was placed on the downstream side of the core. This filter was designed to eliminate the possibility of piping of the impervious material into the compacted chalk, and to provide drainage for the impervious core.

Since there was an excess of chalk from the excavations beyond that





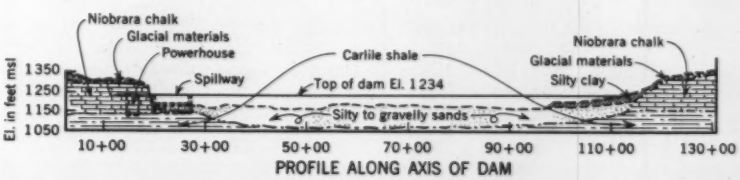


FIG. 2. Blanket of compacted chalk 5 ft thick was placed over alluvial sands for distance of 600 ft upstream from Gavins Point Dam. Also, shell of compacted chalk was placed on both sides of central impervious core of dam.

needed for the main embankment section, chalk was used to protect the upstream slope of the dam instead of the customary hardrock riprap, which would have had to be shipped from some distance. The upstream slope was treated much the same as that at Fort Randall Dam, which showed little erosion after five years. This upstream chalk face was built with a flat slope of 1 on 15 in the range of normal pool elevation and with steeper slopes above and below. The water level in the reservoir will fall on the 1-on-15 slope 90 percent of the total operating time.

Chalk excavated from the powerhouse and spillway areas at Gavins Point Dam was used in the embankment as both uncompacted and compacted fill. Generally the firm gray unweathered Niobrara chalk varied little in moisture. The weathered buff-colored chalk varied from dry to very wet, from a moisture content of 10 to 50 percent.

Various methods were used for excavating the chalk. On one contract, almost entirely in weathered chalk, excavation was done by dragline and shovel, and none of the chalk was blasted. It was hauled to the embankment in 20- and 30-cu yd bottom-dump trucks. Generally the chalk had such a high moisture content that it was necessary to scrape the trucks to keep them clean.

On a second contract, mostly in firm unweathered chalk, the material was loaded by shovel and dragline after being "shot" very lightly, using about 0.20 lb of 40-percent dynamite per cu yd of chalk. The shovel buckets had a capacity up to 8 cu yd and the draglines up to 8½ cu yd. This contractor moved a small amount of weathered chalk by rubber-tired scraper and by loading with an 8½-cu yd walking dragline. The firm chalk was hauled in 31-cu yd bottom-dump Euclids and 35-cu yd (50-ton) end-dump Euclids.

Spreading and compacting chalk

Chalk was hauled from the excavation area and dumped on the fill in windrows or piles depending upon the type of hauling equipment. It was then spread to an uncompacted lift thickness of 12 in. or less. Where the chalk was in large pieces from loading with a large shovel, it was necessary to break the pieces down to the lift thickness by running a tractor or a spike-tooth roller over them.

Sometimes, because of the presence of moisture in the chalk, it was necessary to manipulate and aerate it before compaction. More often it was necessary to water it before and during compaction. No upper limit was placed on moisture content in the specifications except that it should not be high enough to cause deformation of the embankment. The lower limit was optimum moisture.

Chalk was compacted by four complete passes of a spike-tooth roller followed by six complete passes of a tamper roller, or three complete passes of a rubber-tired roller. The spike-tooth rollers were equipped with 10½-in. pointed teeth, removable for easy replacement. Spacing was about three spikes for each 2 sq ft of roller surface. The roller weighed in excess of 50,000 lb.

The tamper roller was equipped with three feet for each 2 sq ft of roller surface. Feet were 9 in. long, with 6 sq in. of area. This roller was weighted to weigh 600 psi. Specifications allowed a variation in weight between 350 and 600 psi but it was found that the heavier weight accomplished the job more satisfactorily.

Rubber-tired rollers had four pneumatic wheels, each tire at 80 psi, and a wheel weight of 25,000 lb. Specifications allowed a variation between 18,000 and 25,000 lb, but again it was found that the heavier weight was better. If the chalk was dry enough to require water, this could be added, it was found, during the spike-tooth rolling, and limited amounts during the later rolling. The addition of water during the rolling appeared to lubricate the chalk fragments and particles so that they could be moved into position more easily.

Specifications allowed compaction after spike-toothing with either the tamper roller or the pneumatic roller. No particular difference in operation or in results was noted between the two. The contractors generally preferred the pneumatic roller because only three complete passes with it were required—as compared to six for the spike-tooth.

An uncompacted chalk fill was placed on the upstream impervious blanket, on a 1 on 15 slope, to provide protection against wave action. The specifications allowed this section to be placed in horizontal layers up to 5 ft thick. The larger part of this section was placed by land methods using the larger pieces of chalk. However, the contractor on the Stage 2 earthwork contract requested, and was given, permission to place a section of the uncompacted chalk by dredging (hydraulic fill).

A 30-in. cutterhead, diesel-electric dredge was therefore used on excavation of firm chalk from the discharge channel downstream of the powerhouse and spillway. A special type of cutterhead was developed for the operation. About 200 to 300 cu yd per hour was excavated—a much lower production rate than that of 1,500 to 2,000 cu yd per hour generally secured in alluvial materials.

The chalk was pumped through a 30-in. line 4,000 to 6,000 ft long and deposited on the upstream slope. Before the chalk was placed by this method, the impervious foundation material was protected by 3 ft of truck-hauled chalk. Dikes were constructed around the fill area and a weir of timber and pipe was constructed to carry off the effluent water. The weir provided a pond of still water 12 ft deep. After the chalk was placed hydraulically it was capped with a 3-ft layer of firm gray chalk. This method of excavation made it unnecessary for the contractor to unwater the area during construction. Although it was an expensive type of excavation, it was very satisfactory and probably saved money in that the dredge would otherwise have been idle during the period.

Good results obtained

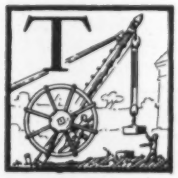
Many samples were taken during placing of the compacted chalk fill. The average dry density of the completed embankment was 88 lb per cu ft compared to 78 lb in the test embankment. Average moisture content was 28 percent, 6 percent lower than that of the test embankment. The higher density and lower moisture contents were attributed to the thinner lifts used in the compacted fill than in the test embankment, and to better control of the compacting equipment. Direct shear tests made on samples of the compacted fill varied from a maximum of tan $\phi = 0.98$ with a cohesion of zero, to tan $\phi = 0.47$ with a cohesion of 0.40. The embankment was designed using tan $\phi = 0.50$, with zero cohesion.

The upstream slopes of the embankment have performed as expected. No appreciable erosion of the chalk has taken place in the two years of operation. A substantial saving was realized on this project by utilizing this soft chalk rock as an embankment material. For these reasons it is suggested that, where large quantities of soft rock must be excavated for structures, an effort be made to use the excavated material in embankment, rather than to borrow more conventional materials at greater cost.

(This article is based on the paper presented by Mr. Sikso at the ASCE Buffalo Convention, at the session of the Committee on Earth Dams, Soil Mechanics and Foundations Division, presided over by Stanley D. Wilson, a member of the Division's Executive Committee.)

Roman Builders of the Republic — Part 2

J. K. FINCH, M. ASCE, Dean Emeritus and Renwick Professor of Civil Engineering, Columbia University, New York, N. Y.



The Romans have long been known not only as great bridge builders but as the first to make extensive use of the stone arch. Yet many notable bridges were built first of timber, and only later, as resources and needs increased, were replaced in stone. Thus legend records that the first bridge over the Tiber at Rome, Pons Sublicius, was a timber structure. It was made famous by the story of Horatius holding it against the Tarquins in the earliest days of Rome.

The timber bridge was also a military device, as many schoolboys have discovered in reading Caesar's *Commentaries*. Trajan built a famous timber trussed arch over the Danube which, following the normal history of such structures, soon succumbed to fire, flood, or decay. Even stone bridges, although safe against fire, were far from immune to such natural hazards as floods, and they frequently were destroyed, at least in part, as a military precaution. The few that have survived the hazards of time have generally been so many times repaired and rebuilt that their original form is difficult to determine.

The Etruscans are usually credited with introducing the Romans to the arch, and the first Italian arch probably dates back to Etruscan days, possibly 600 B.C. The first stone arch bridge at Rome is said to have been carried away four times by flood, to have been rebuilt using old material, and to have long since disappeared. Thus the evolutionary steps, if any, in the development of the Roman stone arch are lacking. Our only evidence is those few examples of what may be called the mature and fully developed basic form which endured throughout Roman times, the full centered, semicircular arch with massive piers.

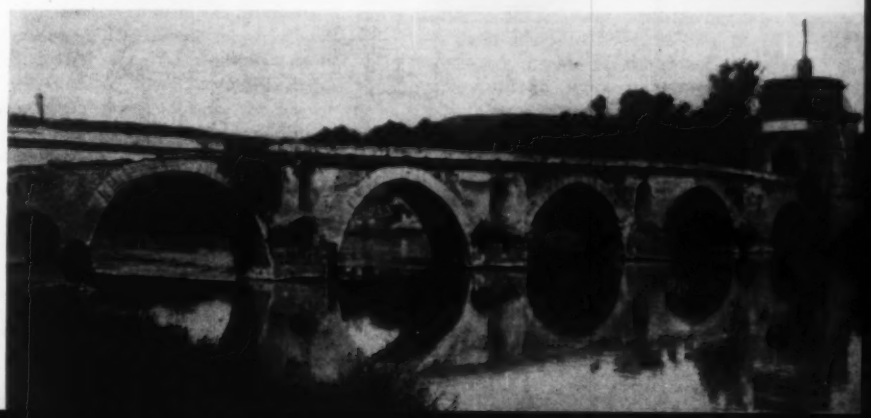
One of the earliest bridges at Rome, Pons Amelius, was, it is said, erected with stone piers and a timber floor in 181 B.C. Some forty years later, it is recorded, stone arches were built, a sequence which was repeated in several other situations.

Pons Mulvius, now known as Ponte Molle, which replaced an earlier timber bridge over the Tiber on the Flaminian Way a short distance above Rome, is said to be one of the oldest bridges still standing in this area in its original form. It was built in 109 B.C. by M. Aemilius Scaurus, who was active in road improvements and extensions. It has seven spans, varying from 51 to 79 ft, a width of 29 ft, and a length of 413 ft. Although later ornamented with roadway end arches by Augustus, and extensively repaired and "improved" in 1808, it still retains the rugged simplicity and the feeling of massive stability characteristic of Roman arches. It successfully carried heavy military equipment in World War II.

We note in this typical work the basic features of the Roman low-level crossing—the full-centered arches of unequal span and number, with the major arch opening "on axis," esthetically balanced and impressively stable. Here are also the characteristic massive piers and the ornament severely limited to simple moldings marking the extrados of the arch rings and the floor line. This full, semicircular arch, with a rise equal to half the span, was doubtless chosen for its simplicity, which facilitated the cutting of the ring stones or voussoirs, and because it was realized that, in general, the thrust resulting from the compressive action of the ring stones follows the curvature of the arch. Thus the load on the pier is close to vertical, and the high outward thrust of the segmental arch is avoided. With heavy piers, each span is self-supporting, a great advantage in construction over the segmental form in which thrust opposes thrust and complete centering of the entire crossing is essential.

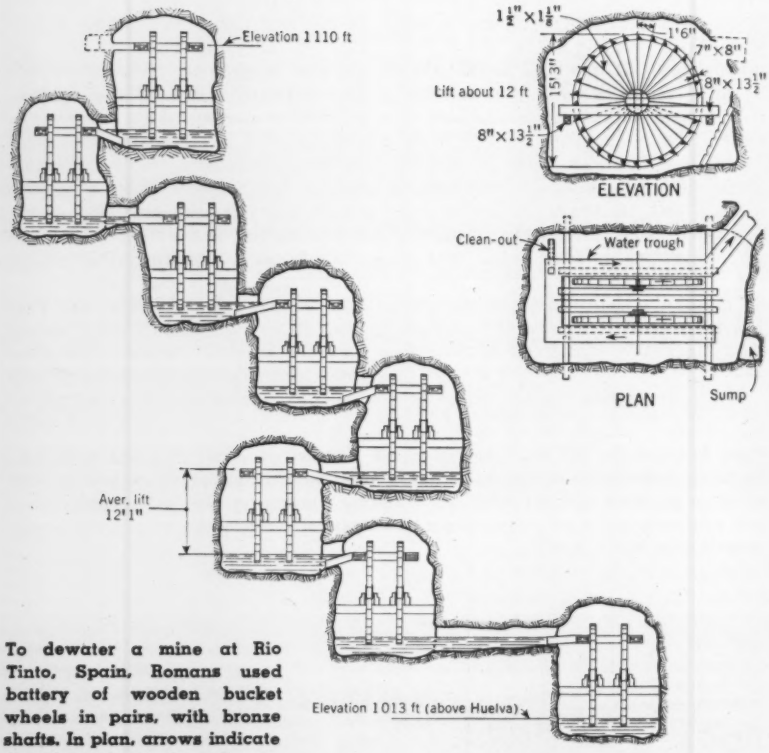
These were unquestionably major advantages, and it was not until the later Middle Ages that the segmental form of arch appeared. But it should be noted that the Roman form posed some embarrassing problems. Where the banks of the stream were high, an

Pons Mulvius (c. 109 B.C.) is typical of Roman low-level crossings with full-centered semicircular arches and massive piers with triangular cut-waters. In spite of much patching and the addition of entrance gateways, this old Roman bridge still retains much of its original form. It successfully carried heavy military equipment during World War II.



Initial: *Roman builders, although aided by machines such as treadmill hoist, had to rely on manpower for their operation. Horses, lacking adequate harness, were used only as riding or pack animals. Occasionally an ox or donkey turned a windlass.*

Emissarium or outlet to Alban Lake near Rome was provided by a tunnel 3,900 ft long, built, according to legend, in 396 B.C.—in the early days of the Republic. Massive headworks here illustrated in engraving by Piranesi were undoubtedly constructed at a much later date.



To dewater a mine at Rio Tinto, Spain, Romans used battery of wooden bucket wheels in pairs, with bronze shafts. In plan, arrows indicate direction of rotation. Apparently each wheel was operated by a worker treading on peripheral cleats. In installation pictured, 8 pairs of wheels, each with a lift of about 12 ft, were used to lift an estimated 3 cu ft of water per minute to height of about 97 ft.

arch of fairly large radius could be used, since the rise of such an arch is half the span. This was the case at Narni on the Flaminian Way, where the ruins of one of the longest spans attempted by the Romans, a bit over 100 ft, still remain.

But the more usual condition of relatively low banks imposed a severe limit on the length of span if a reasonably level crossing was to be secured. There too, limitations on foundation loads resulted in very massive piers with the result that the structure became, in effect, a dam with holes in it rather than a bridge. In many cases, the arch openings provided less than a third of the normal channel area for the passage of floods. This inevitably resulted in scouring currents which often undermined the piers. These difficulties constituted a basic disadvantage of the stone bridge and continued to perplex builders throughout the centuries of stone construction.

On some of the provincial routes, long, high spans were used but these made it necessary to provide *pedes pontis*, or bridge steps, to permit foot traffic and pack animals to climb up and over the bridge. On some of the Tiber bridges at Rome, the floor level was raised to permit longer spans, and inclines were provided at each end. These are now hidden behind later embankment walls and buried in the debris of the ages, which has raised bank levels some 10 to 15 ft. Another plan used to increase the waterway area—and one that reappears in much later French bridges—was to insert small arch openings over the piers.

Our knowledge of Roman bridge foundations rests almost entirely on the famous treatise of Vitruvius. He describes diverting a stream first to one side of the channel and then to the other by means of an earth cofferdam, to permit the piers to be built in the dry. Lack of power pumps and the problem of seepage through such temporary dams, imposed limitations on the depth of bridge foundations, which continued to cause difficulty until well into the 19th century. Even the French engineers of the 18th century, using timber sheeting and similar hand-operated or water-driven pump equipment, were unable to found their piers more than 10 to 15 ft below water level.

Vitruvius advises the use of timber piles, a form of construction long employed by the early lake-dwellers both in Switzerland and in northern Italy. Such piles had to be driven by manpower, some dozen or more men lifting and releasing the weight, or tup, by pulling in unison on a number of hoisting ropes. The piles were small in

size, could not be deeply driven, and of course were limited in bearing capacity.

Loosely piled stones around each pier were usually used as an aid in preventing scour, but undermining of foundations undoubtedly accounts for many bridge failures not only in Roman but also in later times. The most impressive Roman arches were constructed in the succeeding period of the Empire.

Hydraulic works

Two Roman hydraulic works, which apparently date back to the early Republic, are of interest in showing that the *architectus* of the Republic did not confine his activities solely to roads, bridges, and aqueducts.

Some 15 miles south of Rome, two picturesque land-locked lakes occupy ancient craters in the volcanic Alban Mount. Tradition indicates that, as early as 396 B.C., a tunnel 3,900 ft long was dug through the mountain 430 ft below its highest point to drain these Alban lakes. According to legend a delegation sent to the Delphic Oracle in Greece was informed that the last Etruscan stronghold of Trevi would not fall to the Latins until the Alban lakes were drained. Actually the work may have been undertaken to provide irrigation on the outer slope of the Mount. Certainly the monumental inlet and outlet works, beautifully pictured by the 18th century Italian engraver Piranesi, are of a much later date.

The second early hydraulic undertaking bears the date of 270 B.C. It involved the cleaning or widening of a narrow gorge of the River Velino, northwest of Rome, which discharges over the famous Falls of Terni. Over two centuries later this work, or probably a further operation at the same location, led to a well-known lawsuit in which Cicero appeared for one of the litigants. Nature had here provided a restricted passage for flood flows, thus causing the upper valley to act as a retention reservoir in holding back high water. The clearing of the narrow passage thus reduced the flooding of the upper valley but subjected dwellers in lower areas to high flood peaks. Again accurate data are lacking but little more than the excavation of a relatively soft rock seems to have been involved.

The Roman miner

Diodorus, a historian of about 25 B.C., in writing of mining operations in Spain, notes:

"The avarice of the Carthaginians led them to seek for and work mines in all parts of the peninsula, and it was from this source that they obtained the means with which to combat, and for a long period stubbornly to resist, the ultimately superior forces of mighty Rome."

In all probability these mining activities date back to early Phoenician times, perhaps as early as 1000 B.C., while Roman "avarice" very fully exploited these resources beginning about 200 B.C.

The principal mines in Spain today are copper workings in the southwest, in the Rio Tinto area, but Roman records all agree that Spain was once rich in gold and silver. Almost incredible amounts of the latter were said to have been shipped to Rome from Spain. It is said that 60,000 slaves were employed in the northern gold placer deposits and in the silver workings of the south. Apparently these deposits were worked out during the Republic and later operations had to do with the baser metals—copper, lead, tin, and iron—and with the prized coloring material cinnabar.

The Rio Tinto copper mines were worked again after 1870 by a British company, and their huge open-cut operations have brought to light extensive Roman operations at this site. Ancient dump and slag piles are scattered over some 8 sq miles. It has been estimated that the Romans handled about 30 million tons in this area alone. The shallower workings were reached by numerous shafts, and the excavations were extended as far as daring permitted so that huge caves were formed. In the deeper workings, timbered galleries radiated in all directions. Adits or tunnels driven in from the surface were also used, and some of the shafts are reported to have been 820 ft deep.

It is noted that no evidence has been found of a vein's being worked from below—upward "stoping." This method keeps the face always clear since the excavated material falls below. Actually this procedure did not offer special advantages until modern drills and blasting came into use. The other techniques used at Rio Tinto were substantially those followed in mining operations until the advent of modern power tools.

Some of the most interesting remains at Rio Tinto are those indicating the type of machines used. The problem of unwatering the workings was sometimes met by the use of the ancient Archimedian screw-pump, but batteries of wooden bucket wheels were also used. See accompanying illustration. These wheels, in pairs with bronze shafts, are of special interest. Apparently each wheel was operated by a worker treading on the peripheral cleats. In one case 8 pairs of such wheels, each with a lift of about 12 ft, were used to lift an estimated 3 cu ft of water per minute to a height of some 97 ft.

Many other Roman mining operations, scattered from Asia Minor to the British Isles, are mentioned by early writers. In most cases, the remains of the early workings were destroyed by later operations. It is clear, however, that mining was an important element in Roman engineering and economic life, that it was often extensive in scale, and that the Roman miner developed and used techniques which remained practically standard during many later centuries.

Foreign conquests bring problems

The foreign conquests of the Republic involved the organization of large armies and, in the relative respite from wars in the first century B.C., the problem of the returning soldier became pressing. It has been suggested that the construction of the aqueduct Marcia in 145 B.C. was undertaken, in part at least, to provide employment for these troops. At the same time a new trading and capitalistic class was arising in Rome, a new zeal for financial ventures and exploitation was becoming evident, and the problem of food was becoming pressing. Oriental luxuries were imported through Greece. In short "a vast expansion in activities with which the old Roman traditions had not fitted Rome to deal" led to economic and political degeneration and turmoil, and the establishment of the Empire in 31 B.C.

Thus a small tribe of Latins had, through a series of steps which seems almost inevitable, become masters of a world. This domination increasingly posed problems of communication, of control, and of economic organization, to which only the techniques of modern times could have offered a solution. The Republic became the Empire and for some four centuries, Imperial Rome continued to struggle with these vital problems within, and with barbarian forces outside her borders. Under the Empire interesting and impressive engineering works continued to be built in the Italian peninsula. However, as has been mentioned, many of the most noteworthy of the later great engineering undertakings were constructed in the provinces, where Rome endeavored to give, as Vergil said, "the rule of peace to vanquished foes."

(In subsequent issues, Roman engineering works constructed during the Empire will be outlined.)

Is sterilization of sewage by

Can sewage effluent be sterilized by irradiation at the rate of 420 mgd and discharged through a short ocean outfall at a cost competitive with that of discharging effluent through an outfall several miles in length?"

This, in substance, was the question asked by Hyperion Engineers of the Nuclear Science & Engineering Corp. (NSEC) of Pittsburgh, Pa., late in 1955. Hyperion Engineers, a joint venture of Holmes & Narver, Inc., Daniel, Mann, Johnson & Mendenhall, and Koebig & Koebig, had been engaged by the City of Los Angeles to perform design and engineering for modification and expansion work worth more than 40 million dollars on its sewage disposal facilities.

Because of requirements established by the State Water Pollution Control Board, disposal of effluent from the Hyperion Treatment Plant would be a problem of primary magnitude. The increased flow brought about by plant expansion would render the existing mile-long ocean outfall inadequate without expensive chlorination. Construction of a new outfall long enough to insure against beach pollution would cost more than 20 million dollars. This estimated cost convinced Hyperion Engineers that they would be remiss in their obligations to the Los Angeles taxpayers if they failed at least to investigate alternative solutions to the problem. This conviction led to the studies made by NSEC, and to its final report, data from which are included in this article.

Irradiation for sterilization is not new to sanitary engineers. Much has been done on the use of ultraviolet lamps for sterilizing domestic water, and this method is actually in use in some existing facilities. The treatment is not too expensive for small quantities but has the disadvantage of low penetrability even in relatively clear water. However, to treat the 420 mgd anticipated at the city's treatment plant by this method would be extremely expensive, both in operating costs and in space required for the necessary facilities. The fact that the effluent was anything but clear completely ruled out ultraviolet radiation.

High-intensity radiation studied

There remained the possibility of high-intensity radiation, such as can now be obtained by the use of a nuclear reactor. To make such a study, Hyperion Engineers selected NSEC both to investigate the literature and to actually expose samples of Los Angeles sewage in a reactor to determine the amount of radiation necessary to kill the bacteria. NSEC began this work in January 1956 and completed its report in January 1957.

Because of the lack of available information, it was necessary to use a controlled radiation source in order to make even rough estimates of the radiation required. This was accomplished by exposing pure cultures of bacteria to various dosages of irradiation from X-ray machines and to mixtures of neutrons, gamma rays, and X-rays in an atomic reactor.

Samples of raw sewage influent and primary effluent were collected at the Hyperion Treatment Plant by its personnel and placed in one-pint thermos bottles, which were then shipped by air express to Pittsburgh. On receipt by NSEC, the samples were thoroughly shaken and aliquot parts placed in 30-ml polyethylene bottles previously sterilized. Control samples were similarly treated.

Some control specimens and those to be treated were then flown to Brookhaven National Laboratory on Long Island, where the latter were irradiated either in the reactor or by X-ray machine. Some specimens were irradiated at NSEC's plant. Except for some tests at 20 deg C (68 deg F), the samples were kept at about 4 deg C (39 deg F) in a refrigerator both at Brookhaven and at NSEC's plant. While in transit the samples were enclosed in an insulated container.

Following exposure, the irradiated and control samples were returned to NSEC on the day of irradiation, and the various analyses were performed. The poured-plate method, using violet red bile agar, was employed to develop coliform colonies instead of the seven-tube method of "most probable numbers" because of the limitations placed on size of samples by the dimensions of the exposure tubes in the reactor.

Three positions in reactor used

Three positions in the Brookhaven Reactor were used for these studies. Two positions, Pn 1 and Pn 4, have approximately the same radiation characteristics. The values for Pn 1 are 1.9×10^{12} thermal neutrons, 0.13×10^{12} fast neutrons, and 1.4×10^{6} roentgens (R) per hour of gamma radiation. Values for Pn 4 are 1.3×10^{12} thermal neutrons, 0.13×10^{12} fast neutrons, and 1.4×10^{6} R per hour of gamma radiation. The higher flux values for Pn 6 were 3.5×10^{12} thermal neutrons, 0.35×10^{12} fast neutrons, and 1.8×10^{6} R per hour of gamma radiation.

Samples were irradiated in sterile polyethylene vials by insertion in the reactor, and the dosage was determined by residence time in the reactor. The mechanics of the exposure operation is such that 5 sec is the minimum exposure time that can be measured with any degree of accuracy.

Bacterial survival studies were con-

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irradiation economical?

ducted on aliquot parts of the supernatant fluids as well as on the sediment. The studies on the sediment were performed on reconstituted effluent prepared by decantation of the supernatant fluid and resuspension of the solids in sterile distilled water in the amount necessary to restore the original volume. The reconstituted samples were centrifuged again and bacterial counts made on supernatant and sediment.

In addition to the bacteriological studies, the following determinations were made either on the same samples or on ones prepared in an identical manner, utilizing standard methods: total solids, total suspended solids, and total suspended volatile solids. These determinations were performed on control, X-rayed (65,000 and 350,000 R), and pile-irradiated sewage.

Table I illustrates the types of results obtained. It should be noted that the table shows only one sample for each condition. The percentages would not be quite so erratic if a large number of samples had been available and average values had been obtained. In all tests run, the primary effluent that was kept at 4 deg C and exposed for very short periods in the reactor gave very good results. However, the reduction of sewage to a temperature of 4 deg C and its maintenance there are in themselves demanding tasks, so the tests run at 20 deg C are more nearly representative of the usual case.

At 20 deg C the results were very discouraging between 50 and 100 hours after irradiation. In this period the survival rate increased rapidly. It is not known whether this is because the bacteria had overcome a temporary near sterility or because their natural enemies had been killed thus making it possible for the few remaining bacteria to thrive.

TABLE I. Survival of coliforms following reactor irradiation (at Pn 6) and maintenance at 4 deg C and 20 deg C

Time After Irradiation, Hours		Irradiation Time: 5 sec, 4 C	5 sec, 20 C	30 sec, 4 C	30 sec, 20 C	60 sec, 4 C	60 sec, 20 C
9½	Percentage survival	0.728	0.553	0.0003	0.0018	0.0001	0.0000
	Coliforms per ml	5,700	9,630	2.5	32	1	0
30	Percentage survival	0.1610	2.55	0.0001	5.45	0.0001	0.0016
	Coliforms per ml	2,130	47,000	2	100,000	1	113
50	Percentage survival	0.0901	1.63	0.0001	2.17	0.0000	0.0050
	Coliforms per ml	872	13,000	1	18,000	0	43
100	Percentage survival	0.1210	30.69	0.0000	15.67	0.0000	0.0071
	Coliforms per ml	1,200	98,000	0	50,000	0	23

Time, Hours	Control count, per ml: 4 C	20 C
9½	783,000	1,740,000
30	1,320,000	1,850,000
50	968,000	845,000
100	995,000	321,000

It is of interest to note that sedimentation is apparently dependent on radiation dosage. An X-ray dose of 65,000 R caused increased settling of solids from the supernatant, while a dose of 350,000 R, or a pile irradiation, caused an increased amount of solids to be present in the supernatant.

Cost too high

The basic reason for the study, as previously mentioned, was to determine whether the combination of a nuclear reactor and a short ocean outfall was competitive with a long ocean outfall. An outfall 5 miles long, with two 4,000-ft diffusers, will cost over 20 million dollars. To meet the same health standards with a one-mile outfall, it would be necessary to have a maximum survival of 0.1 percent after 100 hours, since the outfall discharges into Santa Monica Bay, a large open-mouthed bay that has a change of water about every 100 hours. No estimate was even attempted for sewage at 20 deg C since the cost of assuring even a maximum of 1-percent survival in primary effluent at 4 deg C was estimated to be 28 million dollars for the reactor and $3,900 per day for operation.

Sterilization of sewage by irradiation doubtless will some day become economically feasible. Before this day comes, however, the sterilization of drinking water by irradiation will be a reality. Both forms of fluid involve large volumes, but sewage presents the additional problems that go with suspended particulate matter.

CONNECTICUT TURNPIKE

in big push for completion

N. E. ARGRAVES, M. ASCE, Commissioner, State Highway Dept., Hartford, Conn.

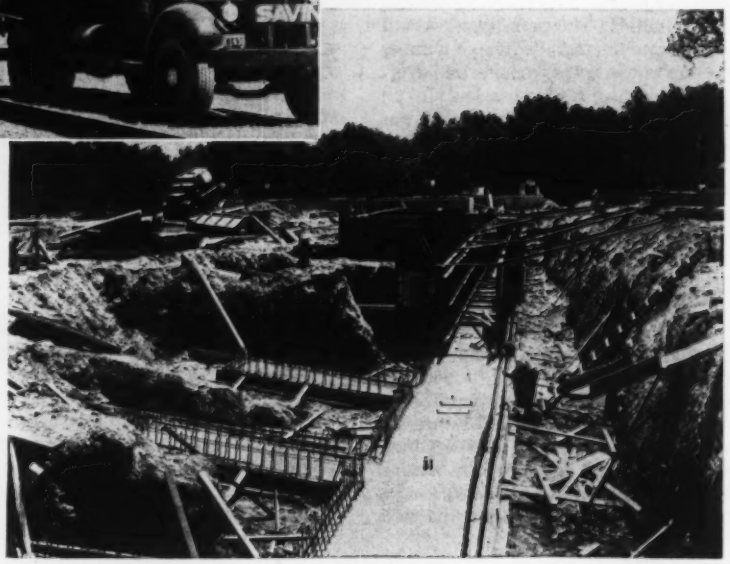
More than 70 prime contractors and innumerable subcontractors are pushing the 129-mile-long Connecticut Turnpike, including 274 important bridge structures, to completion this season. The cement strike has seriously slowed construction through July, but by some adjustment of schedules, most of the road still can be a usable facility on the target date of December 31. See map, Fig. 1.

The half-billion-dollar Connecticut Turnpike is the state's largest public service project. It is a major part of the route designed to speed all classes of traffic from New York City to Maine. In addition to providing for Connecticut's huge through traffic, the new facility is designed to give special advantages to local traffic, with maximum relief for heavily congested city streets.

The expressway has more than a hundred entrance and exit points, 59 of these in the 49-mile distance from the New York line to New Haven, and unlike most toll highways the Turnpike thus has many free sections. It has only eight toll stations, all of the barrier type at enlarged plazas on the main road. This encourages local traffic to use the facilities but requires setting fees for all stations so that through traffic will pay the toll rather than bypass the stations. Even more important, however, is the primary purpose of giving maximum traffic relief to the heavily traveled parallel streets and highways which constitute the Boston Post Road (U. S. 1).

The Boston Post Road has frequently required relief. Since the start

Bituminous concrete pavement is used on most of Connecticut Turnpike east of New Haven, and Portland cement concrete on westerly part. Shown at top are two blacktop spreaders on eastbound lanes at Guilford. Immediately above, paver in foreground lays first course of concrete on which wire mesh reinforcement is placed. Following paver completes concrete slab near Milford. (All photos, Connecticut Highway Department)



Tunnel provides access to 12-lane toll station at Norwalk. All collections are made at road-block stations on main line of Turnpike.

of the motor age, in the 1920's, it was widened from its original two lanes to four—undivided. Hardly was this expansion completed when the mounting traffic totals again called for action. The Merritt Parkway was projected to the north of the Post Road and constructed by stages during the middle and late thirties. A four-lane divided parkway with limited access, it provided a new route for passenger vehicles from the New York State line to the Housatonic River. It was opened in successive sections in 1938, 1939 and 1940. As a result, traffic on the Post Road was reduced by more than 25 percent. But traffic continued to grow and the Post Road problem reappeared. In fact, the current traffic on U. S. 1 exceeds the 1936 volume which made construction of the Merritt Parkway imperative.

Adequate funds for engineering of a turnpike were not available until 1953. Prior to that time, a study of the general location had been conducted using blown-up U. S. G. S. maps and some photogrammetric location maps, generally 200 ft to the inch. In these studies, consideration was given to an inland route instead of the location that was finally established. Studies disclosed that an inland route would require extensive and expensive connectors to serve the urban areas to the south, along the shore of Long Island Sound. The distance of such a route from the highly urbanized areas along the shore would not have rendered satisfactory traffic service to the large urban areas. Also, the study revealed, a route inland would not furnish material relief of Post Road congestion. Once again it was shown that roads must be built where people want to travel.

The Connecticut Turnpike is expected to lead to tremendous economic development not only in the towns through which it passes but in the adjacent tier of towns as well. To determine the actual effect, the Highway Department is making studies in cooperation with the University of Connecticut and the Federal Bureau of Public Roads. This study will use 1954 as the base year and will resurvey the effects of the Turnpike in the year 1960.

The survey will cover the social and economic effects of the Turnpike on eastern Connecticut. It will be divided into several sections covering (1) industrial development, (2) retail trade and professional services, (3) recreation, (4) local government, and (5) real estate values. This study will give us the factual data which have been needed for the social and economic phases of highway engineering—phases which have become equal in importance to the old physical criteria of grade, curvature, earthwork quantities, and similar data.

The route of the expressway traverses 28 towns and cities. It cuts through the densely populated and heavily industrialized areas of Stamford, Norwalk, Bridgeport, and New Haven. Its nearness to New London and Norwich includes those cities in the centers to be served directly by it. Since it connects a number of industrial and defense areas, it has a high degree of importance as a national defense facility.

A statute of the 1953 General Assembly of Connecticut required the highway commissioner to select engineers of "national skill and reputation" to "confirm in all material respects" the estimates of revenue and costs which the commissioner was required to file in a declaration to the expressway bond committee. This bond committee —consisting of the governor, the state treasurer, the comptroller, the attorney general, the commissioner of finance and control, and the public works commissioner—is charged under the law with approval of proposed bond issues before the bonds can be advertised and sold.

In the fall of 1953 the state highway commissioner engaged Coverdale and Colpitts of New York to establish traffic and revenue data, and Ammann and Whitney, also of New York, to prepare the cost figures. The reports of these two firms were submitted in February 1954. They showed that prospective earnings of $734,319,000 over a 40-year-period would assure that the expressway would be self liquidating. Cost estimates for the expressway, its toll stations and other appurtenances, plus the initial cost of financing, were deemed to require a bond issue of $398,000,000.

The estimates on toll-paying traffic were developed at 14 roadblock stations. A total of 442,319 motorists furnished data on origin and destination. Some 4500 miles were driven to check time and mileage records.

Based on these reports, the bond declaration was submitted by the highway commissioner at the end of April 1954 and approved by the expressway bond committee. Bids for the first issue of bonds in the amount of $100,000,000 were opened in May 1954. A second issue of $100,000,000 was sold in February 1956, and a third of $50,000,000 in the spring of 1957. Additional issues will be sold as needed. Under special legislative authorization, another $25,000,000 issue in short-term notes has been sold to cover costs of the eastern section of the Turnpike.

A restudy of costs in 1956 raised the estimate of bond requirements to $445,000,000. Continued revenue studies indicated that this figure could be met by expressway earnings. The final traffic surveys needed to complete the revenue picture were undertaken in

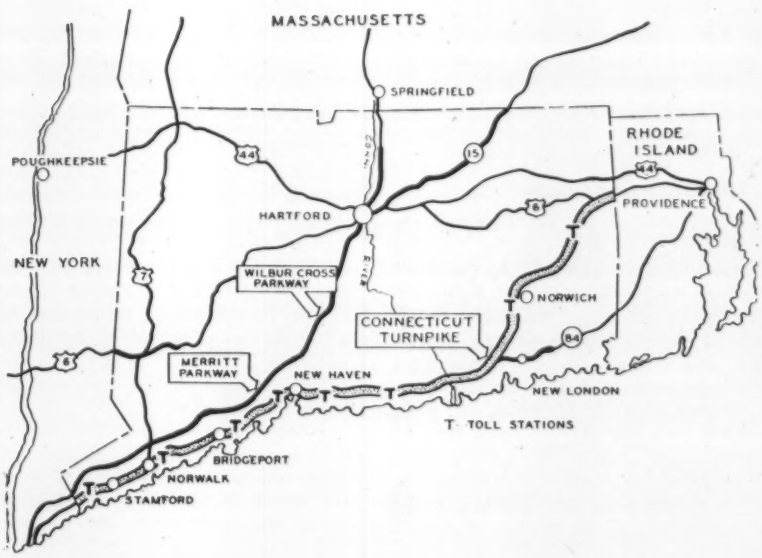


FIG. 1. Connecticut Turnpike extends full width of state. Its length of 129 miles is being pushed to completion this year by 70 prime contractors and innumerable subcontractors.

June of this year (1957) and the publication of the toll schedule is set for this fall, in advance of the Turnpike's opening date, December 31, 1957.

The 129-mile expressway will be a six-lane divided facility from the New York boundary to New Haven with the exception of one eight-lane section in Norwalk and another in Bridgeport. The original provisions called for a four-lane divided highway from New Haven to Flanders and between routes Conn. 32 in Montville and Conn. 2 in Norwich. The intervening sections, between Flanders and Conn. 32, and between Conn. 2 and the Rhode Island line, were scheduled for two travel lanes on the full expressway right-of-way because of smaller traffic volumes. Expansion to divided lanes was to be based on traffic growth. The 1957 General Assembly provided special financing and ordered construction of the additional lanes.

After extensive consideration of all factors concerned, it was decided to use reinforced portland cement concrete pavement on the Turnpike between the New York State line and the Branford connector. From that point eastward, the pavement will be bituminous concrete, except for one section east of the Connecticut River. In this section two new lanes will match two existing reinforced-concrete lanes.

Standards followed in constructing the Turnpike call for 12-ft lane widths with outside shoulders 10 ft wide and paved. In general the right-of-way is 300 ft wide, but some urban locations are limited to 180 ft in width and other areas expanded to 450 ft. Curves in general do not exceed 3 deg and grades are 3 percent or less. The speed posting will be for 60 mph.

The Turnpike will have 53 of its 129 miles lighted. This kind of lighting will encourage the proper use of traffic lanes and the acceptance of available overtaking and passing maneuvers. The new lights will be a major safety factor in the reduction of night-time accidents. They will serve as a background to minimize the effect of headlight glare and intensify driver judgment of speed and travel direction of vehicles.

Two types of lighting will be installed. Seven miles of the route will be provided with fluorescent luminaires and 46 miles with mercury vapor luminaires. The decision to install these lights followed months of tests on a one-mile section of the present Route U. S. 1 in Old Lyme. Fabrication and installation of lighting facilities are now under way.

Roadside and median-strip planting will serve to break up headlight glare, prevent erosion, and hide construction scars. On many sections of the route much of this planting is now being carried out and the remaining areas are due for attention as rapidly as other operations are completed. In some of the urban sections, roadside plantings will also serve as sound shields for adjacent residential areas.

Many structures on route

There are 198 bridges and viaducts to carry the route over railroads, streets, rivers and highways. Another 76 bridges and viaducts carry other facilities over the Turnpike. Eight high-level bridges cross the Byram, Mianus, Norwalk, Saugatuck, Pequonnock, Yellow Mill, Housatonic and Quinnipiac Rivers. The Turnpike crosses the Connecticut River on the existing Raymond E. Baldwin Bridge.

Major structures, including the high-level bridges, are located at 14 points along the Turnpike. The longest bridge is also the one that requires the greatest steel tonnage. This bridge crosses the Quinnipiac River at the head of New Haven harbor. Its 26 spans extend for 3,774 ft, and it has a width of 92 ft. The superstructure and deck call for an estimated 1,285 tons of deformed steel bars, 8,150 tons of structural steel, and 3,270 tons of low-alloy structural steel.

The longest of the big viaducts is in Bridgeport. It crosses the New Haven Railroad and South Avenue. It has 21 spans, a total length of 2,134 ft and an overall width of 117 ft. Bridgeport Harbor Bridge has 21 spans, a total length of 2,490 ft and an overall width of 120 ft. This structure, which also serves as a grade separation above the main line of the New Haven Railroad and adjacent streets, has 15 land piers and 5 water piers.

Lake Saltonstall Bridge near the New Haven-East Haven boundary is 784 ft long and 70 ft wide and requires 15 water piers for its 16 spans. This bridge is notable for being of prestressed concrete construction.

Toll payment made easy

Toll stations on the Turnpike are designed to keep traffic moving smoothly and rapidly. At locations where it is anticipated that traffic will be extremely heavy, toll collectors will enter their booths through underground tunnels. Such an arrangement will prevent mishaps while collectors are reporting to or going off duty. Each toll station will have its own administration building with quarters for highway personnel and State Police officers. Toll lanes will be provided as follows: at Greenwich, 16 lanes; Norwalk, 12 lanes; Stratford, 14 lanes; West Haven, 8 lanes; Branford, 8 lanes; Madison, 6 lanes; Montville 4 lanes; and Plainfield, 4 lanes.

Two different collection systems will be in use at toll stations. The majority of the lanes will handle all types of traffic and will be equipped with treadles in travel lanes and classification buttons in collectors' booths. The classification button will control the patron's fare indicator in the lane and make a remote record in the administration building. Cameras will be installed in all booths as a means of checking the accuracy of classifications. From time to time these will be put in operation for short periods without disturbing the collector.

At certain lanes there will be automatic collection equipment for the use of passenger cars whose drivers have the correct toll fees in coin for deposit in a mechanical hopper. There will be two of these lanes in each direction at Greenwich, Norwalk and Stratford. A single lane in each direction at West Haven and Branford will also have automatic equipment.

For the convenience of trucking companies that will be large users of the Turnpike, a charge card system will be installed. Thus drivers will not require cash for tolls. The charge information will be automatically processed for passage through a Univac machine which will do the billing. Univac will also process the remote-recording tapes as part of the accounting operation on the Turnpike.

Income from services

Service facilities are under construction. They comprise dual gasoline stations at seven locations, five of which include eating facilities. Altogether there are four restaurants and four lunchrooms located singly or in combination at points calculated to best serve users of the Turnpike. These service and eating facilities will be open twenty-four hours a day.

It is estimated that a minium of $450,000 will be realized in rentals and royalties from Turnpike gasoline stations in the first year. With restaurant royalties, this will raise the state's concession receipts to $1,250,201. The Union News Company will pay the state 14 percent of the gross income of the Turnpike food concessions for a 10-year period but never less than a minimum of $801,201 in any year provided Turnpike traffic does not fall below the estimates.

Specifications for operation of concessions provide that "menus and prices are to be suitable to and within the means of the public in general." Seven standard menus are provided which must be adhered to, and a

method is set up for rational price adjustment.

State to pay for maintenance

Maintenance crews and equipment will be based in 15 garages along the Turnpike. Two of these, at Milford and Old Saybrook, are large garages equipped to repair vehicles used in Turnpike maintenance. The other 13 will be for storage of equipment and assembly of personnel. Contracts have been awarded and all the garages are now under construction. Costs for maintaining the Turnpike will be paid out of the regular Highway Fund.

Unlike many toll roads, the Connecticut Turnpike is being handled by the existing State Highway Department rather than by a newly created "authority." The Highway Department did not have sufficient personnel to handle more than general supervision of the work but it did have considerable experience in working with outside consultants. So the work was planned to utilize consulting firms to the fullest extent possible.

For purposes of bridge and highway design, the Turnpike was originally divided into 30 sections. Eventual distribution of the survey and design work brought 27 engineering firms into the work. Remaining units were handled by engineers of the State Highway Department. Architects, roadside, traffic, and concession advisers added eight consultants.

Private consulting firms did the complete job of surveying, planning, designing, and making of detailed plans. The plans were submitted to the Connecticut Highway Department to be checked for compliance with its standards and for general approval. The state called for bids and awarded contracts. In almost all cases the construction contracts were supervised and administered by the consultants who designed the work. Liaison engineers of the State Highway Department followed the general construction, approved consultant-recommended payment, and coordinated the work.

Road and bridge construction was divided into 49 projects for bidding. Forty-five contractors took the work. The fiftieth contract covered the interstate bridge at Byram and Port Chester, which is being handled by the State of New York, costs being shared by the two states.

All contracts for the Turnpike and its appurtenances have been awarded and some have been completed. With fine fall weather, enough cement, a bit of luck, and continued effort by all hands, we can open the Turnpike on schedule.

Steel spans with concrete deck, many of them made composite by spiral shear connectors, are used for most structures on Connecticut Turnpike.

Substructure of viaduct along railroad at Stamford features circular columns with fluting built into the forms.

CONNECTICUT TURNPIKE

Construction in

Traffic interchanges in New Haven and deck of Quinnipiac River crossing are part of Blakeslee's work. Main Quinnipiac Bridge will have two plate-girder spans of 387 ft each, with side spans of 259.5 ft.

H. L. BLAKESLEE, M. ASCE

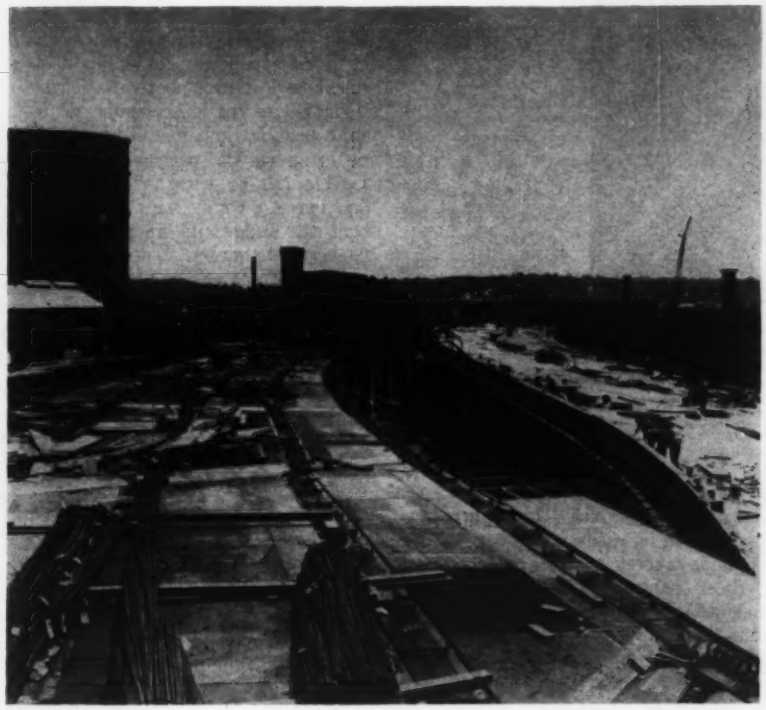
C. W. Blakeslee & Sons, Inc., New Haven, Conn.

Details developed by four generations of Blakeslees are being used to speed construction of the Connecticut Turnpike through New Haven. Ideas for cofferdams, pile driving, forming, concreting and finishing used by C. W. Blakeslee & Sons, Inc., on a succession of moderate-sized structures will be of interest to those in engineered construction.

Blakeslee holds a prime contract in the "can of worms" section of the Turnpike in congested New Haven, where interchange complications have out-twisted the pretzel. The firm was subcontractor for 17 tough cofferdams for the West River in West Haven. And they are putting the deck on the Quinnipiac River Bridge, which has the longest plate girders ever to be erected in the United States. The center spans are each 387 ft long, and the side spans 259.5 ft.

The section in downtown New Haven is built across an area that was once the harbor. Some 30 ft of harbor silt overlies a mica sand that is suitable for bearing. An 8-ft hydraulic fill has been placed to reclaim the general area. But the turnpike is some 25 ft higher to permit local roads to pass under it. Along the line of the Turnpike there is 20 ft of hauled-in fill. To speed consolidation of this fill, a 10- to 12-ft surcharge has been in place between structures for several months. The surcharge is being utilized for backfill, ramps, and the like. Through this area the Turnpike width varies from two to four lanes in each direction as provision is made for connection to the city streets. Concrete

New Haven area



Plywood in loose sheets is laid down for deck form on approach to Quinnipiac Bridge. All form work is done from top, using Richmond hangers and screed chairs.

bents and abutments, all on piles, carry a steel superstructure with concrete deck.

As usual, possession of the right-of-way was delayed far beyond the time contemplated when construction was scheduled. This necessitated driving piling for the structures before the fill was placed. Compaction around the closely spaced piles was achieved by use of a small gasoline-powered tamper, working on closely controlled 1-ft lifts.

Pipe piles 12 in. in diameter of No. 7 gage were driven into the mica sand to penetrations ranging from 30 to 40 ft. A ½-in-thick flat plate was welded on the bottom of the Taylor-Forge spiral weld pipe, received in 70-ft lengths through L. B. Foster Co. Using 100-ft leads and an 11-B-3 McKiernan-Terry hammer, one length was driven to just above ground level. A splice sleeve was used, supplemented by complete welding, to add an additional length. Reaching the required penetration sometimes took up to 20 blows per in. of the 19,150 ft-lb hammer. A standard concave Cobi pile tip was set on top of the pile while driving. Its shape prevented any deformation of the head from slightly eccentric driving—always encountered with battered piles. After use of the Cobi tip was started, no cutting of the pile top was necessary. In general, the lower sections of all piles in a group were driven first; then the upper sections were set on and welded.

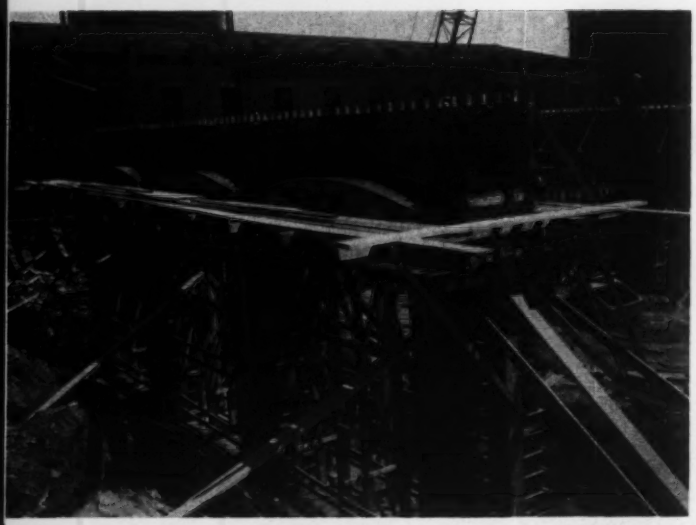
Since about two-thirds of the piles were battered, getting the hammer back on and centered by the usual procedures would have been time consuming. A big Lima crane, purchased as a shovel with short treads, was converted into a pile-driver rig. With some added counterweight, it could travel along the row of piles and nose in on an angle to reach any pile in an abutment, including the battered ones. Extended legs were used on the outside of the hammer, and to these a stiff cable was attached so that it lay nearly horizontal in a half circle. As the leads moved over the pile, the cable caught the pile and directed it under the anvil of the hammer, taking the place of a man working in the leads.

Where heavy overburden was encountered, H-piles were used. They were purchased in 65-ft lengths. A bottom section was first driven and then an additional length was set on, welded, and driven. Conventional splice plates were welded to the top section before setting, so that only tack welding was required while a crane held the piece. Although the H-piles were adopted primarily to penetrate heavy fill, closed-end pipe piles, with less perimeter area than the H-piles, were found easier to drive.

For concrete-bent construction, Blakeslee uses steel column clamps—a method somewhat different from that used by other constructors in the area. And general practice is to form the bottoms of the beams across the columns in the same operation. Column and cap steel are preassembled into cages on the ground and set in one piece, reducing the work and time required at the site. Concrete is placed to the top of the columns, then allowed to set until it attains its initial settlement and shrinkage before the bent is completed.

Abutments are formed and concreted in one operation, even including the end sections of the parapet. It has been found less expensive to hang forms for the minor appendages than to come back with cleaners, form builders, and a concrete crew.

Forms generally are ⅝-in. plywood of concrete-form grade. On the columns, builders' clamps are spaced at 12 in. maximum. Studs are 2 x 4's at 16 in. center to center, with double 2 x 6 walls and ½-in. Richmond Screw Anchor ties.



Columns and caps on Blakeslee contract were formed and concreted as a unit. Builders' clamps speed column forming.

The deck can be formed and stripped more rapidly if the plywood sheets are a little under size. They can be placed more rapidly and are loose when the supports are dropped. A crack up to ⅜ in. in width is covered with self-sticking paper 1½ in. wide. An adhesive has not yet been found that will stick long to oiled plywood, so the paper is also tacked down with a stapler. This paper can be stripped off easily and leaves an acceptable concrete surface.

Steel spans vary greatly to accommodate skews, roadways, and the like. But the typical section is a 43-ft four-lane roadway in each direction with a separator between. Generally there are two deep girders under each 43-ft width with floor beams spaced 20 ft on centers to carry longitudinal wide-flange stringers, which are 6 to 7 ft apart.

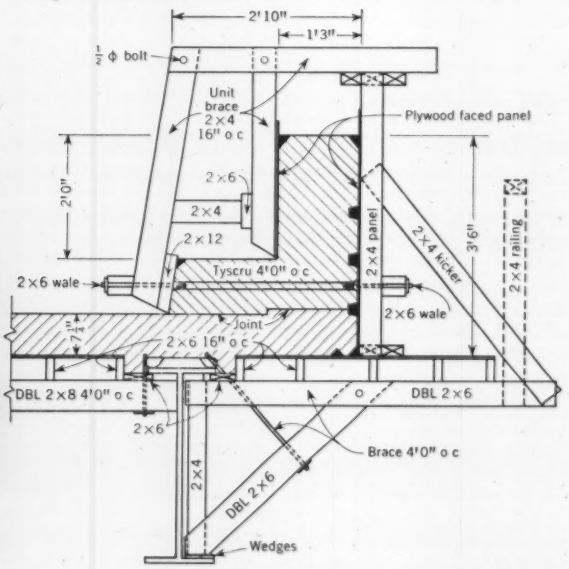
Forms for the concrete deck are of wood. Between stringers, double 2 x 8 transverse hangers, spaced 4 ft 0 in. on centers and held by ½-in. screw ties, carry 2 x 6 stringers spaced 16 in. on centers to support ⅝-in. plywood. The screw ties give accurate adjustment for height to maintain slab thickness despite camber variation.

Outside of the fascia girder, a novel shelf angle of timber, held by a special tie, supports the overhang and curb. Double 2 x 8's, with a 2 x 4 vertical and two 2 x 6's as compression members, are wedged up from the bottom flange of the girder. A detail is shown in Fig. 1. To determine probable deflection and convince some skeptics, a section was load tested to twice the expected weight. Deflection was found to be negligible.

Concrete is placed generally by a crane working from the ground or from an adjacent completed lane. The long plate girders over the Quinnipiac River require balanced placing, which will be done, it is planned, by buggies.

A General Road Machinery Co. concrete finisher operating on lightweight steel beams does the screeding. The finisher supports are set for height by threaded 2-in. pipe that can be easily adjusted. Burlap is dragged over the surface to give the final finish.

FIG. 1. Overhang and curb on New Haven structures were carried on timber frame supported from special hanger. This arrangement permitted placing of all concrete above the deck in one pour. It also provided a work platform for finish rubbing of concrete.



Blakeslee held a subcontract under the Mariani Construction Co. on the bridge over West River at West Haven —Blakeslee to do all the foundations. They were a big order that used up nearly half the money and much of the available time. Seventeen sheetpile cofferdams were required for pier footings in harbor silt so soft that it would not support a man. And the silt was so deep that the economical method of construction was to employ sheetpile cofferdams with tremie seals.

For the large amount of harbor work in the New Haven area, Blakeslee had accumulated more than 600 tons of suitable sheetpiling, which was quickly available for this work. Another 250 tons were obtained on rental.

Floating equipment could easily reach the two river piers; land machines could reach the two abutments and three of the piers. The other 15 bridge foundations required that more than 1800 ft of trestle be built to get to them. These access bridges had to carry cranes rigged for pile driving.

In general the access was on pile trestles. Five-pile bents with the outside piles battered 1 on 5 were spaced on 10-ft centers and capped with 12 x 14's. Stringers were 12 x 12's with 3-in. decking topped by a longitudinal course of 3-in. plank for roadways. When heavy cranes operated on the trestle, "pontoons" of 8 x 12 timbers were laid to spread the load.

Experience over many years in construction in New Haven harbor silt and muck was drawn upon for cofferdam details. Excavation to perhaps 10 ft below low tide was the first operation, followed by installation of temporary wood piling to support the assembly of cofferdam framing. Wood framing was used for cofferdams where excavation prior to pile driving and placing of tremie seal went down below water about 23 ft. Steel framing was utilized for the channel piers, where this excavation went down 36 ft.

Design of cofferdams

Design of the cofferdams required a special approach because of the presence of sand wells in the close vicinity. Subsoil investigations, carried on during the past few years, revealed that the substrata of mica sand underlying the harbor silt was under a hydraulic head because of these sandwells. In the design of the cofferdams this pressure, which would be reflected as uplift, had to be considered.

The borings indicated that the weight of the harbor silt, acting as a plug in the cofferdam, would just about equal the uplift developed by the hydraulic head in the underlying strata. The possibility of a blow-in in the cofferdams, although directly coupled with the porosity of the material, left too slim a safety factor and made it necessary to keep the cofferdams full of water while the pipe piles were being driven within them.

Location of each sheetpile was accurately marked on the framing to warn of any gain or loss in horizontal length that would make it difficult to set the closing piles. Piling used for most of the work was 60 ft long, DP2 section. The complete ring was set before any piles were driven; however the piles settled for more than half of their length in the soft material. Piles in the ring were driven successively not more than 5 ft below adjacent members. Sheetpiling extended from El. + 10 to — 50.

Blakeslee forces long ago developed a guide for spotting and holding a hammer on the sheetpiling. A 9-B-3 McKiernan-Terry was used for most of the sheetpile driving. Bolted to one side of the hammer was a 4-ft section of pile interlock arranged to hold the hammer on top of the next two sheets. A device that looks a little like a car rerailer guides the hammer to the interlock without need for a man up on the sheetpiling. Because of the lack of any major obstructions, the driving was relatively easy to control.

A clamshell bucket on a crane was used for digging through pockets of the framing. While the material would not support appreciable load, it was so sticky it stood up under the wales where the bucket could not reach.

To remove the mud that remained in the "U" of the sheeting and the mud standing under the wales and bracing air lifts in two sizes were constructed. A 6-in. air lift with a 2-in. integral jet was used between the wale and the sheeting. The 8-in. airlift, also with an integral jet, successfully removed the material under the bracing members. This eliminated the need for divers except for inspection purposes.

Special care was taken to clean the space in the "U" of the sheetpiling at the level of the tremie seal, so that the concrete would completely fill the webs. Soft material left there would have permitted water under pressure to enter, resulting in flooding of the cofferdam when pumping-out started.

Pipe foundation piling came in two sizes and many lengths. Armco Spiralweld of 14-in. diameter and 5/16-in. wall thickness, was received in 70-ft lengths. One section was driven, then another was added with a sleeve and welded to complete the length required. Because of pipe shortage, single random-length pipe of 12-in. diameter and 3/8-in. wall thickness was purchased. For economical construction it was welded on the ground into lengths of about 60 to 80 ft.

Welds were made with the relatively new iron-powder electrodes. They are fast and economical but are best suited to downhand welding only. To meet this requirement a bed was laid out using a channel with flanges down, and tack welded to a piece of pipe as cross support. On the web of the channel, casters were installed upside down so that a pipe could roll on them. Once the casters were lined up, they automatically aligned the pipe. A variable-speed roller turned the pipe while a welder at each joint completed the weld in one pass. Some 91,000 ft of pipe piling was installed. For 124,000 lin ft of 12-in. 53-lb and 14-in. 73-lb H bearing piles, a 65-ft length was driven, then another piece added.

Before driving the piling, a layer of gravel was placed over the bottom to stabilize it. After driving, the bottom was checked again for depth, and 2 ft of crushed stone was placed as a base for a 5-ft tremie seal. Stone dust spread generously over the water inside the cofferdam acted to precipitate the silt held in suspension in advance of concreting.

Mariani Construction Co., the general contractors, placed the tremie concrete. Because of the time and schedule limitations, Mariani geared his forces to take immediate advantage of each completed foundation. Close scheduling thus permitted the multi-reuse of sheeting, wales, and bracing.

About a week after the tremie seal was placed, the cofferdam was dewatered. Piling, which had been permitted to extend up through the water to avoid the use of a follower in driving, was cut off. Any water that might have gotten into the pipe piles was removed, and they were filled with concrete. At present Mariani has completed the substructure of 24 piers and three abutments. Steel has been erected and the concrete deck is being placed.

Engineering design and supervision of construction for the work in New Haven are being handled by D. B. Steinman of New York. For the work at West Haven, King and Gavaris, also of New York, are the engineers.

The organization handling operations on the Connecticut Turnpike for C. W. Blakeslee & Sons, Inc. (founded in 1844) is supervised by J. H. Gilbert, Vice President, with G. A. Verrill, Jr., as General Superintendent, and V. C. Arpaia, J.M. ASCE, as Project Superintendent. Messrs. Verrill and Arpaia cooperated in the preparation of this article.

Ingenuity licks bridge foundation problems

Bridges with deep foundations in soft material overlying rock always create major problems for the contractor as well as for the designer. The bridge across Bridgeport Harbor for the Connecticut Turnpike is an illustration. It required the application of imagination and ingenuity both by the contractor, A. S. Wikstrom, Inc., and by the designer, Ammann & Whitney of New York, to bring it to successful completion within the time available.

In this area the Turnpike passes through the downtown business section of Bridgeport. The western land approach to the bridge required demolition of a solid group of buildings extending from the west abutment to the tracks of the New York, New Haven & Hartford Railroad. The bridge runs east and west, and has a length of 2,550 ft. The western land approach is 1,100 ft in length and requires nine piers. At the west bank of the river the bridge crosses over the electrified main line of the New Haven Railroad, which is elevated above the street, requiring piers 60 ft above grade. The river crossing begins at the railroad and continues 900 ft over the harbor, requiring eight water piers plus piers for two approach ramps. The eastern approach is 550 ft long and requires five piers and an abutment. This approach also cuts through a built-up area and crosses the main east-west arterial route through Bridgeport.

All piers are founded on steel H-piles driven to rock with the exception of two in the river, which rest directly on rock in deep cofferdams and one on the river side of the railroad, which is founded on 18-in. pipe piling. The H-piles vary in length from 25 ft to 130 ft, with the shorter lengths on the west side and the longer lengths on the east side of the harbor. About half the piles are driven on a 4 on 1 batter. The material overlying rock is river silt, soft clay, sand and gravel. It did not offer strong resistance to driving until the piles penetrated the sand and gravel strata over the rock.

In the case of the land piers, there was easy access for construction but the usual problem of inadequate work space was aggravated by dense city traffic. These piers were served by conventional crawler cranes and transit-mix trucks. Preassembled wood forms were moved from bent to bent to construct the columns.

On the river piers, more interesting construction problems were encountered. Here a fleet of five derricks, whirleys, and cranes on barges were serviced by work scows and a 42-ft combination tug and work boat, plus "water-taxis," the latter primarily for concrete handling.

The contract called for placing 45,000 cu yd in the substructure. Of this, 16,000 cu yd was planned for tremie concrete made up of individual pours up to 4,000 cu yd. For tremie pours the concrete source had to be completely free from traffic holdups or other delays. This demanded a concrete plant close to the work and controlled by the contractor. Aggregates delivered by water were cheapest. Consequently the 4-cu yd batching plant, from which transit-mix trucks were loaded, was installed a quarter of a mile from the job site, adjacent to the harbor and the railroad tracks. Bulk cement arrived by rail.

Transit-mix trucks haul concrete direct to piers reached by land equipment. For the river piers, they deliver the concrete to 4 cu yd buckets set on water taxis, by means of chutes from a dock near the concrete plant. The taxis are 18 x 30-ft barges equipped with a sea-mule propulsion unit. Three taxis provided a dependable flow of 60 to 70 cu yd per hour. Production reached a high of 80 cu yd per hour during the day and a low of 45 cu yd per hour on the graveyard shift.

The piers in the river are rectangular in plan and average 26 x 130 ft in plan. Each has a tremie concrete seal 12 to 30 ft deep, placed directly on piling in most of the piers.

Construction in the river featured a floating guide for setting cofferdam sheetpiling and framing. A guide unit, 18 x 18 x 52 ft, was used to start construction at each pier and then moved on to another. This unit was built of pipe and floated by displacement of the closed pipe plus four 5 x 5 x 7-ft pontoons (of Seabee origin). As shown in Fig. 1, 12-in. spud wells at the ends and third-points of the 52-ft-long frame accommodate 10-in. pipe spuds.

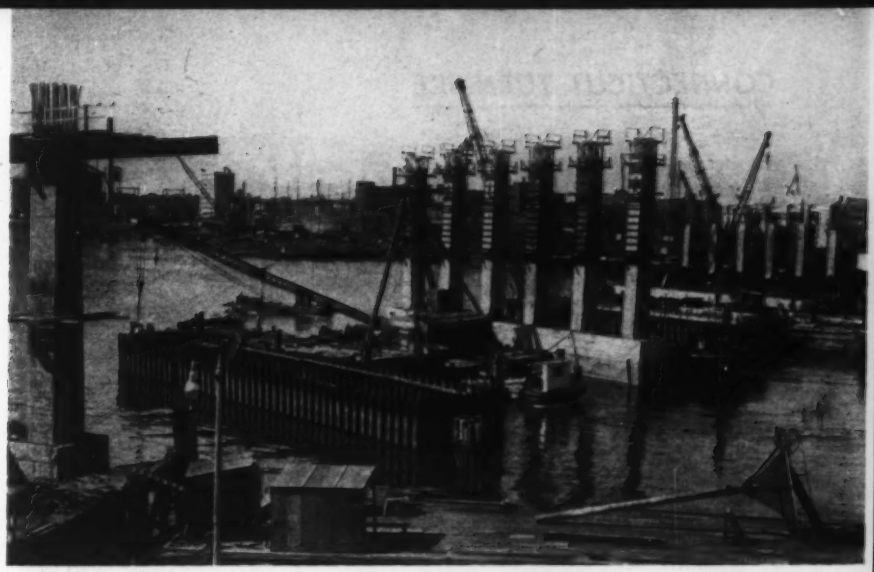
First the guide unit was floated into position and the spuds dropped and driven to hold it. Pins through the spuds prevent fluctuation with the tide. A preassembled frame built to the size of the cofferdam was set on top of the guide and used as the template for driving the sheetpiling, generally a Z 32 section. Sheetpiles were set around three sides of the template and partly driven. The template frame was supported from the sheetpiling, the floatable unit released, the spuds lifted out by crane, and the unit floated out to another pier. Then the cofferdam was closed and the sheetpiles were driven to the full depth.

At typical piers in the river, the driving of bearing piles was made difficult by their length and the deep layer of unstable material on which the cofferdam was founded. Near the east bank of the harbor, the river bottom was at about El. — 10. Borings in a cofferdam there showed 14 ft of very soft silt at one end and 36 ft at the other end. It was agreed that the sheetpiling must go through this layer of soft silt and penetrate into the sand which lay below. To do this required sheetpiles 42 to 58 ft long.

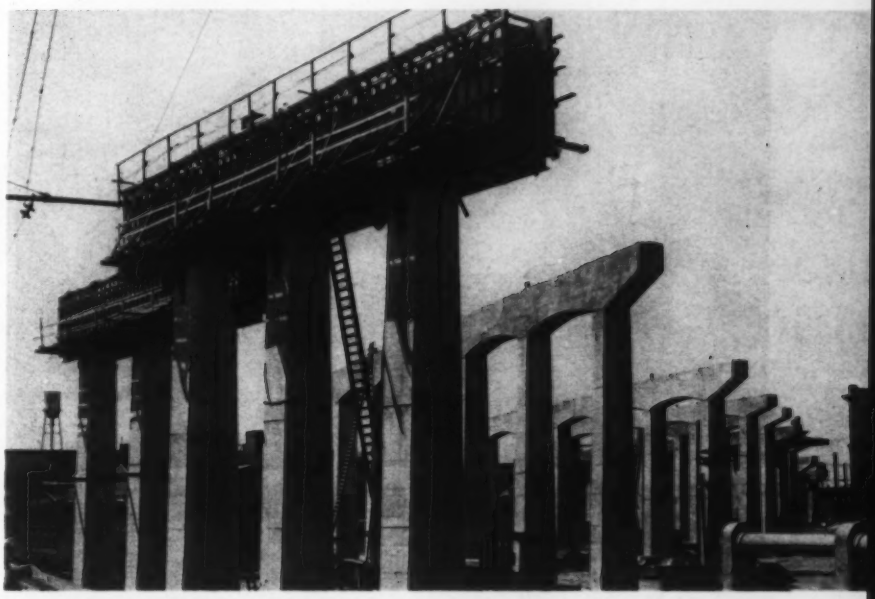
But a real problem arose when bearing piles had to be battered in four directions on a slope of 4 vertical on 1 horizontal. There were a few plumb piles. A geometrical study showed that the batter piles, in many cases, would intersect the cofferdam wall at El. — 27 where the silt extended down to El. — 40 and deeper. Stability required that at least most of the sheetpiles be driven below the intersecting elevation. The solution

A. S. WIKSTROM, A.M. ASCE

A. S. Wikstrom, Inc., Skaneateles, N. Y.



Bridgeport Harbor is filled with Wikstrom equipment. Water-taxi (under boom) is delivering two 4-cu yd buckets of concrete from concrete plant just beyond aggregate barges. Note neat appearance of cofferdams, built around frame on floating template.



Sand jacks on brackets make it easy to strip cap forms. Note proximity to catenary of electrified New Haven Railroad.

was to use three short sheetpiles at each intersecting bearing pile. Seven sheetpiles between each such opening could pass the battered piles and were driven to penetrate at least 6 ft into the firm sand layer.

Before the H-piling was driven, the cofferdam was excavated to El. — 24, and a 5-ft layer of gravel was placed up to El. — 19. The piling, 105 to 120 ft long, was positioned by the use of a traveling carriage, which moved the length of the cofferdam on rollers and contained another wheeled frame that moved at right angles to the main carriage. By computing its position for each pile, the carriage could be moved to the required location, the pile dropped into the opening in the carriage, and the batter established without allowing the point of the pile to touch bottom. This was necessary because the bottom offered no support to the pile as it was being inclined into its correct position.

Other factors that influenced the solution of the problem were: (1) the height of the cofferdam sheeting above water (over which the 120-ft piles had to be lifted); (2) the range of the tide, since floating plant was continually moving up and down with relation to the cofferdam; (3) the height of the boom base, the length of the boom, and the lifting capacity of the rig at various radii; and (4) the fact that the floating driver had access to only one side of the cofferdam.

It can readily be seen that under these circumstances, problems of angle and reach would arise, as a 120-ft pile weighed over 7 tons. No available boom would be long enough to handle a set of hanging leads supporting a 7-ton hammer on top of a 120-ft pile, both of which would have to be lifted over the top of the cofferdam sheeting and into the cofferdam. To meet this situation, a set of leads was designed that moved up and down inside a square frame, which in turn was fastened to the boom tip through a double hinge joint. This allowed the leads to be battered to or away from the rig or to either side. It also allowed both the hammer and the top of the pile to travel above the tip of the boom.

This arrangement worked satisfactorily when the driver was placed directly opposite the pile to be driven, but when this was not possible, a third joint was required in the boom-tip assembly. A ball and socket was then mounted on the boom tip. This arrangement proved unsatisfactory in driving the side batter piles. The best solution was found to be to drive the piles with a free H-section spud as a lead, using a second crane to set the pile in the carriage mounted on the cofferdam frame.

Adding to the difficulties was a hot-applied bituminous coating on the piles for the length below the tremie. This hardened in cold weather to a brittle, glass-like texture. Rollers had to be provided in the driving rig and special care taken to prevent the coating from being scraped off.

Inability to predict the length of

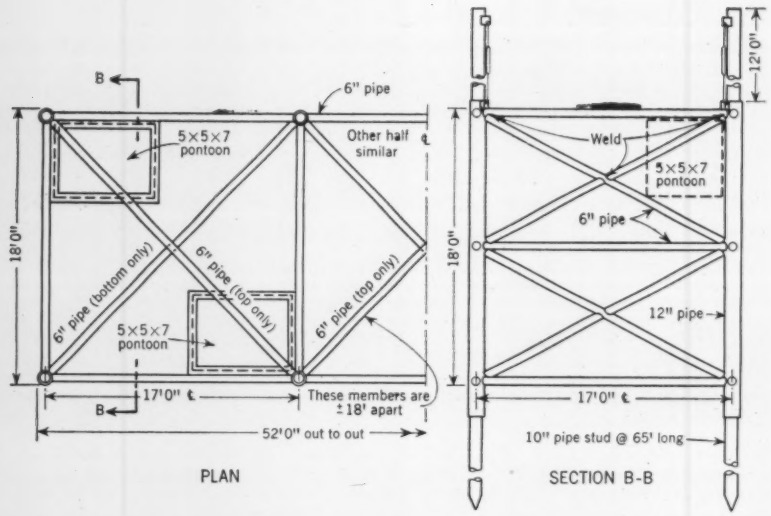


FIG. 1. Pipe guide was floated into position and spuds were driven to support steel-frame template for setting of sheetpiling.

Excavation was a problem at a point along New Haven Railroad where an old abutment on a 3-ft-thick grillage had to be removed. End of cable tie to opposite side of railroad embankment is seen at upper right.

Cofferdam that has been pumped out after placing of tremie seal shows orderly confusion of piles battered in four directions and driven under water.

the piles in advance left many of them projecting high above the cutoff. These long piles, being on a batter and driven under water, interfered with the driving of adjacent piles. Many of them had to be cut off by a diver before driving could continue.

Tremie concrete placing followed conventional practice. A large hopper with pipe attached was held by one floating crane while another rig fed concrete to the hopper. Plastiment, a retarding densifier, was used to improve flow characteristics and reduce heat and laitance in the tremie concrete.

There were special problems on some of the piers. An example is the one adjacent to the New York, New Haven & Hartford Railroad. This pier stands 8 ft from, and parallel to, the north stone masonry retaining wall of the railroad viaduct. On the river side of the railroad, a wall of large native stone masonry was supported on a timber grillage 3 ft thick, carried on wood piles. As this structure had to be removed, it was necessary to provide support for the four main tracks of the railroad. This was done by driving steel ZP sheetpiling to rock about 50 ft below the tracks, and tying this piling back by tie rods under the track.

The plan was to augur through the embankment and install a 24-in. horizontal casing under the tracks. Through the casing, two 2½-in. rods, with turnbuckles, were to be run to tie the upper part of the sheetpiling to a masonry wall on the far side. Because of the numerous cobblestones encountered in the gravel fill under the tracks, the first casing was stopped, after traveling 60 ft under the tracks, by the continuous caving of the material, making forward progress slow and costly.

The final solution of the tieback problem was to jack seven 90-ft lengths of 2-in. extra-heavy pipe under the tracks, permitting the pipe to go where it pleased, since it was impossible to control the direction because of the boulders. Some of the pipes could not be used, but the majority of them came out near the location desired.

A ⅞-in. cable was run through the 2-in. pipe and used to pull a 1⅜-in. cable through the fill. The socket on the 1⅜-in. cable was larger than the pipe; therefore the pipe was pulled out, leaving only the large cable. This was socketed and prestressed to 100,000 lb, reacting against the opposite railroad retaining wall.

To complete the cofferdam, steel sheetpiling was driven and braced in the normal fashion to form the re-

mainder of the enclosure. Excavation included removal of about 300 short pile stubs that formed the support for the old retaining wall. Next, 18-in. pipe piling with a ½-in. wall thickness was driven open-ended to rock, half of the piles on a batter and the other half vertical.

After being cleaned out with air and water jets, about half of the piles were keyed into the rock by drilling sockets 5 ft deep and placing 6-in. beam sections in them before filling with concrete. The drilling was accomplished with a well drill mounted on the cofferdam frame. Not all the old wood piles had been removed. Many of them showed up inside the pipe piles, and their removal gave considerable difficulty. The best method found was to chop them out with a sharpened rail or H-section churned in the pipe.

The rock to which the piles were driven was hard, and it was difficult to obtain a tight seal on the batter piles as their lower edge rested on rock and the end was open to the mud overlying the rock. After the socket holes had been drilled into the rock, a smaller pipe was inserted in the pile to seal off the mud at the rock line. The piles were cleaned out again with air and water jet before concreting, the inside pipe being withdrawn as the pile was filled.

Forms built under water

One pier differed from the others in that its cofferdam and tremie seal were carried all the way to rock, which varied from about El. — 46 to — 62. Here navigation requirements and site conditions introduced several very serious problems, outlined below.

1. The tremie concrete could be poured against the cofferdam sheetpiling in the usual manner from bedrock to El. — 35.25. Above this elevation, channel clearances required that the pier be reduced in width from 28 to 18 ft. Analysis of uplift indicated that top of tremie should be at El. — 23.25 to resist uplift when the cofferdam was pumped out. Thus it was mandatory that forms be provided for the tremie between El. — 35.25 and — 23.25.

2. The cofferdam could not safely be excavated much below El. — 40 without a frame to brace it since the pressure of the material on the outside would tend to bend it inward progressively as the material on the inside was removed. This demanded the placing of a supporting frame just above the predredged bottom, before the interior could be excavated to bedrock.

3. When the cofferdam was first unwatered after pouring of the tremie, a support for the sheeting was required at El. — 13.6 to satisfy the requirements of the hydrostatic loads. The tremie poured against the sheeting provided a support at El. —35.25.

4. Since frames had to be used to support the tremie from El. — 35.25 to — 23.25, and frames also had to be in position before excavating inside the cofferdam, the excavation had to be accomplished with the two frames (including struts on about 10-ft centers) and the 12-ft-high tremie forms in final position below the water surface.

5. A further complicating factor was the requirement that vertical 8 x 8 x 1⅛ angle irons, 28 ft long, be placed around the periphery of the pier 1 ft inside the tremie form. Spaced about 5 ft on centers, for the purpose of tying the tremie concrete to the concrete above placed in the dry, these 1,600-lb members had to be placed and supported under water after the excavation was completed.

After the cofferdam sheeting had been set and driven around the floating pipe guide described above, the usual frame was set—designed for support at El. — 33.5. On this frame, pipe columns were erected and an upper frame, designed for support at El. — 13.6, was assembled on top of the columns. Longitudinal and transverse bracing was installed between the frames, and the tremie form was installed on the struts of the lower frame. The 20-ft-high assembly was lowered so that the bottom was at El. — 33.5 and the upper frame at El. — 13.6. The frames were then tied to the cofferdam sheetpiling.

The frame struts and the tremie forms cut the cofferdam into small rectangular bays that made excavation difficult. The wooden tremie form was particularly vulnerable to damage, and once damaged could be repaired only by divers. It was concluded that excavation would have to be accomplished by an air lift even though the overburden covering the rock consisted of compact silt, sand and gravel. It was a long hard struggle, and little progress was made for long periods. Where the digging was especially difficult, a pointed H-section was raised and dropped by a crane near the air lift to loosen the hard-packed materials. High-pressure jetting, from on top and by diver, was used in breaking up the material so that the air lift could handle it.

When the excavation was completed, it was discovered that the bedrock sloped in such a way that provision had to be made to key the tremie pour firmly into the surface of the rock. Since trenching and blasting were impractical under water and within the limits of the cofferdam, the solution was to drill 22 holes 5 ft into the rock and grout pieces of 14-in. H-piles into them. This was accomplished, but only with considerable effort, by means of a drill mounted on the cofferdam framing.

After the H-sections were placed, the long 8 x 8 x 1⅛-in. angle dowels were lowered into position, supported by pipe cylinders previously set inside the tremie forms at the proper spacing. The tremie was poured in two stages, the first from the rock surface to El. — 35.25, and immediately after its initial set, that part within the tremie forms from El. — 35.25 to — 23.25. The struts and cross bracing were left permanently embedded in the tremie concrete.

One pier was lagging behind the time schedule because of difficulty in reaching final grade on rock, as it was found necessary to go 10 to 15 ft deeper than planned through dense cemented sand and gravel that made excavation a tedious, time-consuming chore. The possibility of placing the tremie seal up to the under side of the granite facing in one pour was suggested by the consulting engineers. To make a flat surface for setting the granite facing, it was necessary to level off the concrete in the dry, although the pour was started as a tremie. This pour of 2,000 cu yd was 40 ft in depth. When it reached a height of 5 ft from the top, pumps were started and the cofferdam was unwatered, so that the last 2 ft was placed in the dry. No problem was encountered in unwatering nor was there any leakage of water through the concrete or along the sheetpiling, even though the concreting had started only 35 hours before.

Pressure to expedite the work has been constantly applied on this $6,000,000 foundation project. Because of a steel strike, sufficient sheetpiling and H-piling were not available until September 1956. By September 1957 the concrete work will be completed and steel erection should be under way so that there will be no delay in opening this section of the Connecticut Turnpike to traffic.

William B. Delehanty is resident engineer on the project for Ammann & Whitney; Nomer Gray, M. ASCE, is general construction engineer for the firm. Overall supervision for the Connecticut Highway Department is under S. C. Amidon, division engineer at Westport.

For A. S. Wikstrom, Inc., Fred Johnson is project manager and John Sutter, chief engineer.

HOW TO RECRUIT GRADUATING ENGINEERS

This symposium has been abstracted from the papers presented by the authors at ASCE's Jackson Convention, before the Conditions of Practice session presided over by Norman R. Moore, Vice President, Zone III, and Vice Chairman, Department of Conditions of Practice.

From the viewpoint of a consulting engineer

WAYNE F. PALMER, M. ASCE, President, Palmer & Baker, Inc., Mobile, Ala.

The problem of recruitment of engineers is basically economic. What I want most to discuss today, tomorrow, and many tomorrows is the basic problem of the civil engineering profession —economics—for this is the hub of the recruitment problem from the time of choice of a career to retirement.

My company has refused to join the hordes of interviewers that swarm around engineering graduates with all the flattery and cajolery of a high school fraternity rushing season. We feel that just because some university has put a rubber stamp on a hopeful —inferring that he is an engineer— this does not prove that he is.

We feel that to indiscriminately scatter pay far above the graduate's immediate worth is doing an injury to the young engineer quite equal to that done the profession. We believe that to squander the limited income of the profession on new graduates will so decrease the funds available for the pay of experienced engineers that great injustice will result to the older men who have heavy family responsibilities.

My company does not spurn new graduates. Many of them have valuable potentialities. When we receive a letter from a young man approaching the end of his academic life, indicating that he knows about our special type of work and feels his future requires early training in our field, under our senior engineers, we believe he is taking a serious approach to his engineering career and we move over and find a place on the bench for him. It is with such men that we hope to build for the future of our company.

Today, when the engineer has reached a position in the esteem of the public never before attained, applications flow in from fine, able engineers —not natural drifters—showing page after page of associations with great projects. These men of ability are forced to pick up their careers and their tents and move about like harvest labor following the ripening crops. For example, one large consulting firm told me recently it was forced to reduce its staff from 360 to 25.

I am proud to be associated with the American Society of Civil Engineers and to feel that I too am a member of this group that is remaking America—remaking in fact the physical face of the world in order that men everywhere may live a better life. But are these dreams enough? Apparently not, for today the civil engineering profession finds itself ill equipped to assume the opportunities that are being offered it. This group of men, with all their individual talents, as a unit undoubtedly forms one of the most ill managed segments of our economy.

I may be charged with wanting to commercialize our profession. But why dodge an obvious fact? When any one of us accepted our first dollar of fee, we became commercial and entered the nation's commercial life. Something perverse in the minds of many engineers causes them to feel that the realization of their plans and efforts places them above the sordid financial plane. Pride in accomplishment is not restricted to the engineer. It is just as much the reward of the lawyer or the doctor or the manufacturer. Yet they assure themselves of proper reward for their abilities. The engineer likewise in selling his services must bring into the profession adequate remuneration, without which he cannot properly remunerate his associates.

The shortage of engineers is indica-

tive of the failure of the profession to restaff itself adequately. Further evidence is the ferment among our members who are turning to unionization.

Two years ago I went to Sweden to report on a proposed tunnel under the harbor of Gothenburg. My round trip of 13,000 miles was solely to report to the unionized engineers of the port on the project for which we were jointly responsible. Before my arrival, a difficulty between the stevedores and the port management over service in the port cafeteria had forced the unionized engineers to join the stevedores and go out on strike. So I was forced to travel another 13,000 miles a month later to have the benefit of a discussion with these engineers. These top-notch professional men were forced to obey the edict of the stevedores. Do we want this?

I was privileged recently to spend an evening with our President and a group of Directors. We discussed frankly some of the economic ills of the profession. At every point I was confronted with the statement, "Our lawyers say 'no'." Can't we, for a change, run our own business and attain an income and dignity equal to those of the members of the Bar?

I was advised some time ago that a new curve of recommended fees was under study by the Board of Directors. It is still under study. Today, a new curve could be most useful, considering the current rapid award of contracts on the highway program. The curve that dictates engineering fees on military contracts is far out of relation with the Society's curve. One or two men, I am told, in the upper altitudes of the Defense Department dictated this curve, and thousands of engineers have submitted to this type of price fixing.

When the government engineer cuts the consultant to the bone on his fee, he is in fact down-rating his own profession, because the profession cannot disburse to its members more than it earns. Why don't they do the same to the contractors' figures? Why is the engineer his own worst enemy? Why a different outlook on the fees of his fellows than on the other elements of construction? Why is it that many good engineers that have been the backbone of county and city governments are earning as little as $4,000 a year?

These, I believe, are things that must be done to induce young men to enter the profession and to provide adequate future reward for their abilities:

1. Secure adequate salaries and fees.
2. Uphold the corporate practice of engineering. This is the only way a private firm can accumulate adequate reserves to carry it through the inevitable lean periods and assure continuity of employment for its staff.
3. Penalize improper competition quickly and firmly.
4. Develop a strong sense of group responsibility. Back the Board of Direction in its efforts to raise the income of all members of the profession.

From the viewpoint of an industry

ROY T. SESSUMS, M. ASCE

Assistant to Vice President and Engineering Coordinator, Freeport Sulphur Company, New Orleans, La.

Industry is in agreement that there is a real problem—a real and critical shortage of trained engineers. In 1955, the educational institutions of the United States produced some 23,000 engineers. Industry reported a need for about 40,000 in that year. This year our schools expect to graduate about 28,000, and the need is purported to be in excess of 40,000.

The present and projected requirements of industry and the military are so huge that a doubling of enrollments in engineering schools during the next ten years may not provide enough. So industry faces not one but two problems—the recruiting of sufficient talent to meet present needs and the long-range problem of insuring the continuing interest of young people in the study of engineering.

It is good to note that industry is making fair progress toward solving the second of these problems. Nationwide efforts are under way to assist secondary schools in interesting more students to prepare for engineering careers; in attracting better science and engineering teachers and improving their pay; and in enabling working engineers to carry on graduate study.

Now let us take a look at the immediate problem of recruitment, which carries with it the corollary of keeping men once we get them. The state employment services are helpful sources, as are the semi-public "employment agencies" like veterans' organizations and professional societies which ordinarily offer such a service only to their own members. Then there are referrals of friends and relatives of present employees, which some firms have encouraged by distributing prospect cards to employees along with their employee publications.

Some companies keep close tabs on service discharge centers, attempting to nab the desirable veteran. Others pick up personnel released in plant shutdowns—a source of highly desirable people with considerable experience. In short, industry has been burning some high-priced midnight oil to unearth engineering talent.

But the most productive source continues to be the engineering colleges, a source we tap directly through on-campus recruiting. This approach is best for a number of reasons. It is more efficient as it is possible to see and personally evaluate a greater percentage of "possibles and probables" in a shorter period of time, and horseback estimates can be validated by reference to candidates' scholastic records and by chats with professors. Then too, the graduate-to-be is very approachable on the campus. One of the major reasons for this type of recruitment is that if we don't use it we will end up with a choice of leftovers.

The key to the problem is *selection*. Two of the principal tools of selection used today are the personal interview and the scientific test. Of the two, I favor the properly conducted interview. Nothing can surpass it for getting at a man's motivations and revealing the sort of person he really is.

Assuming now that we have the right man in the right place, what can be done toward assuring that he will remain with us and increase in worth and productivity?

We must examine the causes of dissatisfaction reported to be at the root of the engineering turnover, and one of its outstanding results—the formation and spread of unions. Job dis-

satisfaction has led nearly 60,000 of our nation's 500,000 engineers to join unions. A recent National Industrial Conference Board survey breaks down the reasons for engineers' discontent into three general areas: (1) salary, (2) individual grievances, and (3) professional.

The engineer's complaints about salary and benefits are these. He says the earnings differential between him and ordinary wage-earners is too narrow now, and that any edge he might have had in fringe benefits has largely been wiped out. He seems to feel that *his* company does not pay as well as other companies, and that merit is sometimes subordinated to seniority in determining salary increases.

The engineer's feelings of dissatisfaction are related to a loss of status: he objects to personnel treatment on a mass basis. He is vitally affected by the disappearance of the old personal relationship between himself and his employer or supervisor. He wants training and job rotation to help equip him for more responsibility and eventual promotion. Professionally, he asks to be classified as an integral part of management. He wants more personal credit for the work he does. The list of complaints seems merely one part of a larger problem—the need for change in the manner in which management responds to the changing needs of its people.

I suspect that complaints about pay and benefits can only be resolved by the economics of the particular industry. An expanding industry should not face any difficulty in this area. It is my opinion that, owing to supply and demand, the present salaries of beginning engineers are ample. However, this may not be true of engineers with five to ten years of experience. In many cases management should critically review the salaries being paid engineers with this category of experience, and where necessary make proper adjustments.

Individual grievances are, generally speaking, of greater concern than salaries. All of us can work toward alleviating these causes of dissatisfaction by fulfilling the managerial responsibility of achieving effective results with our people, or may I say by establishing better *communication* with them. To know our people and have them know us, to make sure they understand what we expect and must have from them, and that we in turn understand them and their needs—this is the essence of communication.

When over a third of the engineer resignations are traceable to supervisory problems, we can assume that it is management's move—and that we have to get into action fast. The industrial tempo of today dictates that we move a man along faster. If both he and his company are to survive and prosper, then he must mature more quickly. We must help him to do this. We must be sure that he gets the wholehearted assistance and counsel of his supervisors and our executives. We must see that he gets the necessary training, both on and off the job. The engineer so treated is not likely to pose a retention problem, and is very likely to enrich our organizations in terms of accomplishment as well as money.

From the viewpoint of a state highway department

REX M. WHITTON, M. ASCE

Chief Engineer, Missouri State Highway Commission, Jefferson City, Mo.

Enactment of the new Federal-Aid Highway Program has served to focus attention more than ever before on one of the fast-mounting problems of highway engineering—recruitment of, and holding of, a sufficient number of graduate engineers to do the job at hand. I'm told our problem in Missouri is common to most state highway organizations at the moment. Also, since our schools admittedly are not turning out enough engineers to meet current demands, we are facing tougher and tougher competition from industry, transportation, consultants, and even federal agencies.

It is alarming to us that only 15 percent of all civil engineers graduated in 1955 accepted highway jobs. They represented only 3 percent of the total number of engineering graduates. I can't help pointing out also that draftsmen, other types of technical personnel, and even skilled workers, are likewise in short supply.

As a natural result of the engineer shortage, highway departments have adopted new means of recruiting and holding needed personnel. We in Missouri, for example, set up a personnel section in 1952, headed by an engineer, and turned all our personnel problems over to him. From results achieved thus far we recommend such a practice for any highway department.

Our personnel engineer has found it necessary to adopt the practice of industry in seeking personnel—go into the field and get it at its source, the schools. But before actually going to the schools, other things must be done. It is essential to set up an employee program that will attract the prospective graduate. As a result of engineer shortages, salaries have edged up and are still on the move. But today's graduate is looking for more than salary—in fact salary is often secondary. He wants fringe benefits, such as job training, job security, job location, advancement possibilities, vacation and sick leave, an insurance program, and a retirement program.

With the engineer shortage pinching us severely soon after we adopted our 10-year highway modernization and expansion program in 1952, one of the first moves of our personnel engineer was to examine salary schedules. As is usually the case in highway departments, and most state or public agencies, because of revenue and statutory limitations our starting salaries were low compared to those of industry. Although we made some decided changes and today do compete favorably, we still have a considerable way to go. The graduate today is looking to the future. One of the first questions he asks is what about pay increases. Too often highway departments face a major hurdle in that they cannot offer such increases as rapidly as can the private employer. We may eventually be forced to adopt definite increases, possibly on an annual basis.

We in Missouri took some more lessons from industry, after we examined our fringe benefits. Job security is no problem with us, of course, because our constitution takes political aspects out of our hiring, and more than 600 of our employees have completed 25 years or more of service. But old-age security has become a major requirement of employees. Such a program was enacted by our legislature last year, and it has been of tremendous help to us in meeting our personnel needs.

Training programs within the organization also have become attractive as job benefits in recent years. The new graduate today wants to move up quickly and welcomes the training program as an opportunity to get acquainted with the organization and to find his particular niche in it without delay. We have such a program in Missouri and our trainees indicate they find it one of our most popular features.

Enjoyable working surroundings are requisites in all fields today. Important too, and almost necessities, are hospital and life insurance programs, definite vacation and sick-leave plans. Our employees also have set up, with Commission consent, a credit union which has proved quite popular.

With an acceptable schedule of job benefits to offer, the next problem faced is where to go to recruit young engineers. Private industry has an unlimited field—they recruit anywhere. One consulting firm, for example, asked our personnel engineer if it might come into our main office and talk to some of our designers.

We, like most other highway departments, center our attention on the schools. Here again we are faced with a problem. Which schools? Quite a few no longer emphasize the highway field. Rather, they stress engineering management. And regardless of which school we go to, the competition is tough because the civil engineer, the one we want most, is more desired in all fields because he usually has the broader education.

It has been our experience, and I think it is a generally accepted fact, that the average graduate prefers a location not too far distant from his home. We take this into consideration in planning our recruitment program and limit our active efforts to schools located in our own state and adjacent states.

The greater the cooperation of school officials, the greater will be the success in recruiting that school's graduates. We therefore take every opportunity to build friendship at the school, with considerable success. Last year at one school we were fortunate enough to employ 5 of the 11 civil engineering graduates.

Through our personnel office we have taken still another step we hope will be helpful to us—this is the setting up of a cooperative engineer training program with two schools in our state, the University of Missouri and the Missouri School of Mines and Metallurgy. Under this program our Commission plans each year to sponsor the attendance at these schools of 30 high school graduates with an aptitude for civil engineering. These students, selected on the basis of ability and need of assistance, will work for the Commission during the summer and attend school the rest of the year.

Thus far we have 40 students in training, 20 at each school. If they complete their civil engineering course, we hope to recruit them as permanent engineer employees. If they switch to another engineering field, they are dropped from the program. We are sold on this program, which has been well received in our state, and recommend it highly to others.

The manpower problem is not one that can be solved by an engineering formula. Here we must enter the field of human relations, a field that has become increasingly important in recent years. Every effort must be made to convince the young engineer that there is a rewarding future in highway engineering. Then, when he enters the field, it is up to us to see that the promise is fulfilled or we won't keep him.

The new federal-aid highway program will go a long ways toward helping us in our recruiting job. We in the highway field long have been faced with the obstacle of lack of an adequate, long-term highway program. Without such a program we could offer little definite hope for job security. Now with a long-term program definitely accepted at all levels, we are in an entirely different position and should hasten to take advantage of the opportunity it offers.

From the viewpoint of the Corps of Engineers

S. R. HANMER, Brigadier General, United States Army;

Assistant Chief of Engineers for Personnel, Washington, D. C.

The need for intensive recruiting of graduating engineers is of course only symptomatic of a deeper, more basic and vital problem—that of assuring the education of a sufficient number of engineers to meet the needs of the nation in a new and critical phase in world history.

First, as to recruitment, it is little wonder that the engineering student is in many ways the most popular man on the American college campus today. Just about everybody wants him. And in spite of this great need and the efforts to date to increase the output of engineers, the supply still falls seriously short. The Corps of Engineers has not been exempt from this shortage.

The Corps of Engineers, in addition to supporting the largest peace-time army in our history and readying itself for its combat roles in war, is the largest single construction agency in the world. To accomplish its far-flung and varied mission, the Corps has an officer strength of 8,650, an enlisted personnel strength of 74,000, and a civilian work-force strength of 57,000. Of these civilians, more than 8,700 are professional engineers; of these about 78 percent are civil engineers.

The turnover of our civilian engineers can be illustrated by a few statis-

tics for the 4½-year period, July 1, 1951, to December 31, 1955. At the start of this period, we had 7,500 engineers. To increase this number to 8,140 we hired 5,014 engineers. In other words, it took the hiring of about 5,000 new engineers to attain a net increase of only 640. Our 1956 turnover in professional engineers was 12.4 percent, or about 1 percent per month. Our recruitment lag (outstanding requirements over 30 days old as compared to total engineer requirements) is currently 8.8 percent.

It has been the policy of the Corps to concentrate on recruitment of young college graduates in order to keep our organization young, vigorous and well informed on recent developments. Our college recruitment effort, therefore, is highly organized. The 10 Division Engineers have been assigned responsibility for recruiting in all the engineering colleges within their geographical boundaries. Recruiting teams, composed of engineers and personnel people, generally include a recent graduate of the school being visited, who can speak the "language" of the students. In addition, Division and District Engineers and key members of their staffs maintain close liaison with college placement officials throughout the year. Many field offices also conduct student tours of their work projects.

Recruiting techniques

As to the techniques used by our recruiting teams, each Division Engineer is free to use his ingenuity. We have provided a brochure covering the varied professional work of the Corps, and a color film depicting the activities of young engineers in the Corps.

Since the salaries we are permitted to offer are strictly controlled by law, our entrance salary is generally considerably below those offered by private industry. This is true despite two recent adjustments upward. At present the starting salary is $373 per month as compared to between $400 and $500 offered by other employers. We are continuously seeking to raise this amount as we are convinced that we must offer adequate initial salaries.

We have developed, and have had in effect for a number of years, what we believe is an excellent rotational training program for Junior Engineers, described in detail in a booklet we have published. Since this program has been approved by the Civil Service Commission, we are able to promote young engineers from grade GS-5 to grade GS-7, at $444 per month, at the end of six months. Under Civil Service standards, the young engineer is eligible for further promotion to grade GS-9, at a salary of $510 per month, one year later. A full career progression is open for our engineers from the project and District level to the Division level, and finally to the high-level staff position in the Office of the Chief of Engineers in Washington. We are constantly striving to improve this program.

As a supplement to our college recruitment program, we encourage our field offices to employ, during the summer months, as many engineering students as funds and work programs permit. Through this summer employment, we try to interest college students in a career with the Corps.

Our student cooperative program has been in existence in a number of our Districts and Divisions for many years. It has many variations. The most popular one is along this line: A position is established in the Corps for the level of experience and ability that would be found in the average college freshmen in an engineering course. Two students from a cooperating engineering school are selected for this position. One goes to school for six months while the other occupies the position; then they change places. More difficult positions are established for second-, third-, and fourth-year students. At present we have 18 such programs, with a total of 193 student employees participating and are encouraging the establishment of additional programs. Each year, a few more such programs are established.

Results show progress

Now as to results, we have not recruited as many young graduate engineers as we need. However, we have made progress. For example, in the fiscal year 1957, we placed 252 college graduates in the Junior Engineer Rotational Program as compared to 192 in fiscal year 1956—a 32-percent increase.

Although the program today is primarily directed toward the recruitment of graduate engineers as civilian personnel, I must mention the coordinate problem of the great need of the Corps for young men to serve both as Reserve and Regular Army officers. Such a career, I can testify from personal experience, will provide one of the most satisfying and challenging experiences any engineer can desire. Not only is it essential to the defense of our nation, but it also contributes to the country's economic welfare.

Engineer shortage is critical

I now come to the truly basic problem with which we are all faced—the critical shortage of engineers. On the world front, as many responsible voices have warned, the American people as a whole are not yet conscious of the handwriting on the wall which clearly relates our educational crisis to our national security—the fact that Russia can surpass us technologically through intensive technical education of its people and dedication to its undeviating purpose of world communism under Soviet domination. Russia is working toward our isolation and collapse through a strategy, alternate to nuclear attack, which embodies economic, political and psychological competition for the minds and substance of the rest of the world. Soviet Party Boss Khrushchev stated in Moscow on September 15, 1955:

"We don't have to fight. Let us have peaceful competition and we will show you where the truth lies . . . Victory is ours."

What should be done?

To survive and to remain prosperous in this new era, we must overcome our shortage of scientists, engineers, semi-professional manpower, and other technically trained minds. What must we do to overcome this shortage? We must make up our major shortages in school plant. We must make up deficiencies in the number and quality of teachers for all types of education. And finally, we must develop the full potentialities of the minds of our children. At the annual convention of the American Council on Education in October 1955, it was brought out that:

"Half of the top-ranking quarter of high school graduates—perhaps 250,000 students annually—reached the twelfth grade with their ability fully developed but did not go on to college. Half of these 250,000 present only a problem of financing. They have said, in various studies made in recent years, that they would go on to college if the financial aid were available."

Knowing what we must do, how should it be done?

We must take bold, imaginative, and concrete steps to solve the problem. Government at all levels, industry, business, educators, and great engineering societies such as the ASCE, must join hands toward developing a concrete plan for improving our educational system at all levels at whatever the cost may be. Let no one underestimate the difficulty of such a job in the face of deep-seated and opposing convictions shared by regions, groups, and individuals. But certainly, in the face of the recognized national peril, we must and can work out early and truly effective solutions to this problem.

AMERICAN SOCIETY OF CIVIL ENGINEERS

1957 New York Annual Convention

Hotel Statler **October 14-18, 1957**

REGISTRATION

Mezzanine Foyer, Hotel Statler

Opens 9:00 a.m., Monday, Oct. 14; each Convention day 9:00 a.m. to 5:00 p.m.

Registration fee $4.00 (except women and students).

ADVANCE INFORMATION ON ATTENDANCE

To assure adequate preparation to make your attendance at the Annual Convention most satisfactory, the Committee requests your assistance. It will be most helpful to have guidance in the number of persons to be expected for the various functions. Will you please use the coupon on page 154, which is to be sent to Barclay G. Johnson, Convention Chairman.

This does not constitute registration. It will be necessary to register when you arrive at the Convention.

Do not send a check covering all events. The only event for which advance payment is required is the Dinner-Dance on October 16, as detailed in the program.

Your help in furnishing this advance information will measurably facilitate the planning of the Committee.

AUTHORS' BREAKFASTS

East Room **Hotel Statler**

8:15 a.m. each Convention day

Briefing sessions for speakers, discussers and program officials by invitation only.

Presiding: THOMAS J. FRATAR, Vice Chairman, New York Annual Convention Committee.

HOTEL ACCOMMODATIONS

Headquarters of the Annual Convention will be the Hotel Statler, on Seventh Avenue between 32nd and 33rd Streets, directly opposite, and connected to, the Pennsylvania Station. Special arrangements have been made to accommodate many Convention visitors at the headquarters hotel, up to capacity, in the order that reservation requests are received. Send your reservation request early to assure space at the headquarters hotel. For your convenience, a special request form is provided on page 108. Late requests may have to be assigned to other nearby hotels.

KICKOFF PARTY

Monday, Oct. 14

5:30-7:00 p.m. Ivy Suite, Georgian Room

Cocktails, dancing and entertainment

At this first general gathering of the Convention, the cordial hospitality of the Metropolitan Section will be enjoyed. All who have paid the registration fee, and their wives, are welcome, with tickets for admission without charge. For those who have not paid the registration fee, a per person ticket charge of $3.00 will be made.

CIVIL ENGINEERING SHOW

9:00 a.m. to 6:00 p.m., Mon. through Thurs., 9:00 to 12:30 Friday, Mezzanine

Thirty-one firms supplying materials, equipment and services used in the various fields of civil engineering will participate in the first Civil Engineering Show. The exhibit will afford an opportunity to observe first hand the latest developments available to the practicing engineer.

PROFESSIONAL UNITY LUNCHEON

Monday, Oct. 14

12:15 p.m. **Georgian Room**

Sponsored by the Committee on Conditions of Practice

Greetings of New York: ROBERT F. WAGNER, Mayor, City of New York.

Speaker: JOSEPH W. BARKER, Chairman of the Board, Research Corp.; President, Engineers Joint Council.

Subject: Unity in the Engineering Profession.

Toastmaster: GLENN W. HOLCOMB, Vice President, ASCE, Chairman, Committee on Conditions of Practice.

All members, guests and friends of the Society are invited to attend, sharing the topic of timely concern to the profession.

Per plate, $4.75. Tickets for this event should be purchased before 10:00 a.m. on Monday.

MONDAY MORNING

OCT. 14

Conditions of Practice Committee

9:30 a.m. **West Room**

Report of Task Committee on Study of Economic Advancement Objectives

Presiding: Glenn W. Holcomb, Chairman, Committee on Conditions of Practice

Moderator: Lloyd D. Knapp, Chairman, Task Committee on Study of Economic Advancement Objectives

9:30 The Committee's Assignment
LLOYD D. KNAPP, M. ASCE, Com-

missioner of Public Works, Milwaukee, Wis.

9:45 Legal Implications
BEN R. CLARK, ASCE Legal Counsel.

10:05 Long-Range Recommendations
CHARLES YODER, M. ASCE, Consulting Engr., Milwaukee, Wis.

10:25 Short-Range Recommendations
LAWRENCE ELSENER, M. ASCE, Vice-President, Chicago Bridge & Iron Co.

10:40 Prepared discussions
MILTON ALPERN, J.M. ASCE, President, Metropolitan Section Junior Forum; THOMAS C. SHEDD, M. ASCE, Prof., Univ. of Illinois; and an employee of a U. S. Government agency.

11:30 Forum discussion with the Committee acting as a panel

Engineering Mechanics Division

9:30 a.m. — Ivy Room

Plastic Design

Presiding: D. C. Drucker, Member, Executive Committee, Engineering Mechanics Division

9:30 Introduction to Plastic Analysis and Design
LYNN S. BEEDLE, A.M. ASCE, Chairman, Structural Metals Div., Lehigh Univ., Bethlehem, Pa.

10:00 Plastic Design of Cover-Plated Continuous Beams
E. P. POPOV, A.M. ASCE, Prof. of Civ. Eng., Univ. of Calif.; J. A. WILLIS, J.M. ASCE, Structural Engr., San Diego, Calif.

10:30 Rotation Capacity of Beams and Frames
G. C. DRISCOLL, JR., J.M. ASCE, Graduate Asst., Civ. Eng., Lehigh Univ., Bethlehem, Pa.

11:00 Inelastic Lateral Buckling
B. THURLIMANN, A.M. ASCE, Research Assoc. Prof., and W. WHITE, Lehigh Univ., Bethlehem, Pa.

Power Division

9:30 a.m. — Hartford Room

Civil Engineering Aspects of Thermal Plants

Presiding: R. A. Sutherland, Member, Executive Committee, Power Division

9:30 Civil Engineering Features of the Linden Plant of the New Jersey Public Service Company
A. VERDUIN, A.M. ASCE, Civil Engr., Ebasco Services Inc., New York.

10:00 Circulating Water Systems of Steam Power Plants
R. T. RICHARDS, A.M. ASCE, Civil Engr., Ebasco Services Inc., New York.

10:30 Discussion

Sanitary Engineering Division

9:30 a.m. — East Room

Sewerage and Sewage Treatment

Presiding: Richard R. Kennedy, Member, Executive Committee, Sanitary Engineering Div.

9:30 Pittsburgh's New Tunnel Sewers to Operate Under Controlled Submergence
JOHN LABOON, M. ASCE, Chairman of Board and Chief Engr., Allegheny County Sanitary Authority, Pittsburgh, Pa.

10:15 Effects of Decreasing the Aeration Period in Modified Aeration
WILBUR TORPEY, M. ASCE, Senior Civil Engr.; and MARTIN LANG, City Dept. of Public Works, New York.

11:00 Maintenance of Fine Bubble Diffusion Under Varying Operating Conditions
PHILIP MORGAN, M. ASCE, Prof. of Sanitary Eng., State Univ. of Iowa, Iowa City.

Surveying and Mapping Division

9:30 a.m. — Dallas Room

Presiding: O. J. Marshall, Chairman, Executive Committee, Surveying and Mapping Division

9:30 The Geodimeter and Tellurometer-Electronic Distance Measuring Equipment
AUSTIN C. POLING, U. S. Coast & Geodetic Survey, Washington, D. C.

10:00 Coordinated Engineering and Photogrammetry for Highways
JOHN E. MEYER and CARLOS A. WEBER, M. ASCE, Michigan State Highway Dept., Lansing.

10:30 Geodetic Control for the Florida-Cuba Beyond-the-Horizon Radio System
MAX O. LAIRD, M. ASCE, Amer. Telephone & Telegraph Co., New York; ING. ANTONIO AQUILAR, Saenz-Cancio-Martin, Ingenieros, Havana, Cuba.

11:00 Discussion of Interim Report of the Task Committee on Status of Surveying and Mapping
B. AUSTIN BARRY, A.M. ASCE, Manhattan College, New York; ALFRED O. QUINN, M. ASCE, Aero Service Corp., Philadelphia; GEORGE D. WHITMORE, M. ASCE, U. S. Geological Survey, Washington, D. C.

MONDAY AFTERNOON

OCT. 14

Conditions of Practice Committee

2:30 p.m. — Georgian Room

Session on Education

Sponsored by the Task Committee on Professional Education

Presiding: NORMAN R. MOORE, Vice Chairman, Committee on Conditions of Practice

Moderator: CAREY H. BROWN, Board Contact Member, Task Committee on Professional Education

2:30 Introduction and Summary of Committee Activities
CAREY H. BROWN

2:45 Limitations of General Surveys and Efforts by a Professional Society
ADOLPH J. ACKERMAN, M. ASCE, Consulting Engr., Madison, Wis.

3:10 Facts about Civil Engineering Education
JOHN B. WILBUR, M. ASCE, Head, Dept. of Civ. and Sanitary Eng., Mass. Inst. of Tech.; KIRBY SMITH, M. ASCE, USN (Ret.), Atlanta, Ga.

3:35 Civil Engineering Curricula
F. B. FARQUHARSON, M. ASCE, Director, Eng. Exp. Sta., Univ. of Washington; HARVEY O. BANKS, M. ASCE, Director, Dept. of Water Resources, State of California, Sacramento.

4:00 The Position of ASCE in Civil Engineering Education
N. M. NEWMARK, M. ASCE, Head, Dept. of Civil Eng., Univ. of Illinois, Urbana.

4:25 Conclusions and Recommendations of the Task Committee on Professional Education
ADOLPH J. ACKERMAN, M. ASCE, Consulting Engr., Madison, Wis.

4:50 Discussion

Engineering Mechanics Division

2:30 p.m. Ivy Room

Plastic Design

Presiding: Lynn S. Beedle, Chairman, Committee on Plasticity Related to Design, Eng. Mechanics Div.

2:30 Further Studies of Columns Under Combined Bending and Thrust
T. V. Galambos, J.M. ASCE, and R. L. Ketter, J.M. ASCE, Research Assts., Lehigh Univ., Bethlehem, Pa.

3:00 Design of a Multi-Span Steel Frame
R. L. Ketter, J.M. ASCE, Research Asst., Fritz Eng. Lab., Lehigh Univ., Bethlehem, Pa.

3:30 Structures Designed in the U. S. by Plastic Methods
T. R. Higgins, M. ASCE, Dir. of Eng., and W. A. Milik, Jr., Amer. Inst. of Steel Construction.

4:00 Status of ASCE-WRC Joint Report and of AISC Design Handbook

POWER DIVISION FIELD TRIP

Monday, Oct. 14 **1:30 p.m.**

Visit to Linden Plant of the New Jersey Public Service Company

Buses will leave the 32nd St. entrance of the Hotel Statler at 1:30 p.m. sharp to take those desiring to inspect the Linden Generating Plant of the Public Service Electric and Gas Co. of New Jersey. This is scheduled for 1957 operation and will have an initial capacity of 450,000 kw. This plant will supply process steam to the Bayway refinery of the Esso Standard Oil Company, which adjoins the new station. In return, Esso will furnish fuel oil and water. Very economical operation results from the efficient use of low-level heat energy usually rejected to condenser cooling water. Features of special interest to power engineers are the two units of 225,000 kw each, four steam generators of over 1 million lb per hr each, the large water treatment plant for make-up water, and the special features for handling and burning high-viscosity fuel.

Buses will return to the Statler Hotel at 5:00 p.m. Price per person, $2.00.

Sanitary Engineering Division

2:30 p.m. East Room

Computers in Sanitary Engineering

Presiding: Ray E. Lawrence, Member, Executive Committee, Sanitary Eng. Div.

2:30 Water Distribution System Design and the McIlroy Network Analyzer
Murray B. McPherson, A.M. ASCE, and J. V. Radzuil, Philadelphia Water Dept., Philadelphia, Pa.

3:15 Digital Computers in Sanitary Engineering
Robert L. McIntire, Director, Computing Services, The Datics Corp., Ft. Worth, Tex.

4:00 Digital Computers for Pipeline Network Analysis—a Comparison With Analog Computers
Quintin Graves, M. ASCE, Prof., School of Civ. Eng., Oklahoma A. & M. College, Stillwater; and Don Branscome, J.M. ASCE, Sales Engineer, Alcoa, Oklahoma City, Okla.

Surveying and Mapping Division

2:30 p.m. Dallas Room

Presiding: O. J. Marshall, Chairman, Executive Committee, Surveying and Mapping Division

2:30 Three-Hour Open Meeting of the Executive Committee of Surveying and Mapping Division

TUESDAY MORNING

OCT. 15

Engineering Mechanics Division

9:30 a.m. Ivy Room

Analog and Digital Computers in Civil Engineering

Sponsored jointly by Committee on Experimental Analysis and Analogues, and Committee on Mathematical Methods

Presiding: Glenn Murphy, Chairman, Committee on Experimental Analysis and Analogues, Engineering Mechanics Division

9:30 Introduction—New Vistas in Civil Engineering Computations
Glenn Murphy

10:00 Electrical Analogs of Static Structures
Frederick L. Ryder, Republic Aviation Corp.

10:30 Applications of Analog Computers to Civil Engineering Problems
Henry M. Paynter, Pi-Square Eng. Co.

11:00 Stiffness Matrix Method of Structural Analysis
John S. Archer, M. ASCE, Senior Structures Engr., Convair, Fort Worth, Tex.

Power and Construction Divisions, Joint Session

9:30 a.m. Hartford Room

Civil Engineering Aspects of Thermal Plants

Presiding: R. A. Sutherland, Member, Executive Committee, Power Division

9:30 Underground Power Plants in Sweden
K. V. T. Nilsson, M. ASCE, Civ. Eng. Director, Swedish State Power Board.

10:00 Underground Power Plants
Adolph J. Ackerman, M. ASCE, Consulting Engr., Madison, Wis.

10:30 Discussion

Highway Division

9:15 p.m. Ballroom

Presiding: Harmer E. Davis, Chairman, Executive Committee, Highway Division

The Interstate System in Urbanized Areas—an Administrative Problem for All Levels of Government

9:15 The Role of the Federal Government
Frank Turner, M. ASCE, Deputy Commissioner, Bur. of Public Roads, Washington, D. C.

9:35 The Role of the State
Rex M. Whitton, M. ASCE, Chief Engr., Missouri State Highway Commission, Jefferson City.

9:55 The Role of the County
John B. Benson, Jr., A.M. ASCE, Covington County Engr., Andalusia, Ala.

10:15 The Role of the City
James E. Lister, Planning Director, City Planning Commission, Cleveland, Ohio.

10:35 Discussion

11:00 U. S. Steel film (public premiere) "Jonah and the Highway" *(see box following)*

PUBLIC FILM PREMIERE "JONAH AND THE HIGHWAY"

11:00 a.m. Ballroom

The Highway Division is presenting, for its premiere, the U. S. Steel Corporation film entitled "Jonah and the Highway." This is the first film to be produced that deals exclusively with the highway engineer and his job. It tells a dramatic and interesting story of two highway engineers and their part in building a road. The story is designed to be of interest to the general public as well as to the technical audience.

The principal purposes of the film are to create a desire on the part of high school students to study engineering in college, and to demonstrate the vital impact of the Federal Highway Program on the nation's economy and the key role played by the highway engineer in the largest public works program in world history.

This premiere showing before ASCE has been arranged by the Highway Division, with the generous cooperation of the U. S. Steel Corporation, as a matter of special interest to the members.

Sanitary Engineering Division

9:30 a.m. East Room

Water Supply

Presiding: Richard Hazen, Chairman, Executive Committee, Sanitary Engineering Div.

9:30 Design of Water Supply Structures
H. J. CARLOCK, A.M. ASCE, Chief Design Engr., Amer. Water Works Service Co., Philadelphia, Pa.

10:00 Forced Circulation of Large Bodies of Water
THOMAS RIDDICK, M. ASCE, Consulting Engr., New York.

10:30 Water Storage Reservoir Evaporation Reduction
WALTER U. GARSTKA, M. ASCE; WILLIS T. MORAN; and LLOYD O. TIMBLIN; River Regulation Sect., U. S. Bureau of Reclamation, Denver, Colo.

11:00 Discussion
C. H. HULL, M. ASCE, Sanitary Engr.; and SHEPPARD T. POWELL, Baltimore, Md.

Structural Division

9:30 a.m. West Room

Wind Forces

Presiding: John M. Biggs, Chairman, Committee on Wind Forces, Structural Division

9:30 Introduction
JOHN M. BIGGS, A.M. ASCE, Dept. of Civil Eng., Mass. Inst. of Tech., Cambridge.

9:40 The Nature of the Wind
R. H. SHERLOCK, M. ASCE, Univ. of Michigan, Ann Arbor.

10:05 Fundamental Considerations
J. J. KOZAK, A.M. ASCE, State Div. of Highways, Bridge Dept., Sacramento, Calif.; and GLENN B. WOODRUFF, M. ASCE, Consulting Engr., San Francisco, Calif.

10:30 Wind Forces on Enclosed Structures
THOMAS W. SINGELL, A.M. ASCE, Chief Building Design Engr., Dresser IDECO Co., Columbus, Ohio.

10:55 Wind Forces on Open Structures
W. WATTERS PAGON, M. ASCE, Consulting Engr., Baltimore, Md.

11:20 Structures Subject to Oscillation
F. B. FARQUHARSON, M. ASCE, Dir., Eng. Exp. Sta., Univ. of Washington, Seattle.

TUESDAY AFTERNOON

OCT. 15

Engineering Mechanics Division

2:30 p.m. Dallas Room

Analog and Digital Computers in Civil Engineering

Sponsored Jointly by Committee on Experimental Analysis and Analogues and Committee on Mathematical Methods

Presiding: Walter J. Austin, Chairman, Committee on Mathematical Methods, Engineering Mechanics Division

2:30 Electronic Computation in Civil Engineering
H. A. RADZIKOWSKI, Chief of Development, U. S. Bur. of Public Roads, Washington, D. C.

3:00 The Electronic Digital Computer and Its Application to Highway Engineering
SYLVESTER E. RIDGE, M. ASCE, Asst. Chief of Development, Bur. of Public Roads, Washington, D. C.

3:30 Some Applications of Digital Computers in Structural Research
A. S. VELETSOS, J.M. ASCE, Research Assoc. Prof., Univ. of Illinois, Urbana.

Highway Division

2:30 p.m. Ivy Room

Location and Design Problems in Urban and Rural Areas

Presiding: William A. McWilliams, Vice Chairman, Executive Committee, Highway Div.

2:30 Variations in the Application of Interstate Design Standards in Urban and Rural Areas
JACOB C. YOUNG, M. ASCE, Porter, Urquhart, McCreary and O'Brien, Newark, N. J.

3:00 Economic and Traffic Considerations in Interchange Location
JACK LEISCH, A.M. ASCE, DeLeuw, Cather & Co., Chicago, Ill.

3:30 Integrated Planning of Arterial Highways and City Streets in the Lowell-Lawrence-Haverhill Region
GUY KELCEY, M. ASCE, Partner, and GEORGE LELAND, A.M. ASCE, Chief Engr., Edwards, Kelcey & Beck, Newark, N. J.

4:15 Reconstruction of Connecticut's Flood-Damaged Bridges and Highways
NEWMAN E. ARGRAVES, M. ASCE, Commissioner, Connecticut State Highway Dept., Hartford.

Hydraulics Division

2:30 p.m. Hartford Room

Sponsored by Committee on Design and Committee on Research, Hydraulics Division

Presiding: Carl E. Kindsvater, Member, Executive Committee, and Leslie J. Hooper, Chairman, Committee on Design, Hydraulics Division

2:30 Some Experiments with Emergency Spillways
WARREN B. MCBIRNEY, A.M. ASCE, Research Engr., Hydraulics Investigation Sect., Bur. of Reclamation, Denver, Colo.

3:00 Air Binding in Long Pipelines Flowing Under Vacuum
RICHARD T. RICHARDS, A.M. ASCE, Civ. Engr., Ebasco Services, Inc., New York.

3:30 Design Criteria for Development for Siphonic Action in Pumping Plant Discharge Lines

A. JOSEPH MOORS, A.M. ASCE, Hydraulic Engr., Ohio River Div. Office, Corps of Engineers, Cincinnati, Ohio.

4:00 Model Studies of Littleton Development

DAVID R. CAMPBELL, Project Engr., New England Power Service Co., Boston, Mass.

Sanitary Engineering Division

2:30 p.m. East Room

Air Pollution

Presiding: Roy J. Morton, Member, Executive Committee, Sanitary Engineering Division

2:30 Importance of Local Meteorological Conditions on Evaluation of Atmospheric Pollution Problems

A. L. DANIS, Prof., Univ. of Florida, Gainesville.

3:15 Effects of Air Pollution on Airport Visibility

WILLIAM T. INGRAM, M. ASCE, Adjunct Prof., and LOUIS C. MCCABE, Consultant, Research Div., New York Univ., New York.

4:00 Engineers Joint Council Air Pollution Abatement Policy Statement

CHARLES BISHOP, Director, Chem. Process Development, U. S. Steel Corp., Pittsburgh, Pa.

Structural Division

2:30 p.m. West Room

Forces on Aircraft Frames

Presiding: George S. Vincent, Member, Executive Committee, Structural Div.

2:30 Load Determination

R. L. CREEL, Airframe Design Div., Bur. of Aeronautics, Navy Dept., Washington, D. C.

3:00 Stress Analysis

WARNER LANSING, Grumman Aircraft Eng. Corp., Bethpage, L. I., N. Y.

3:30 Special Problems and Applications to Static Structures

H. W. SMITH, Staff Engr., Boeing Airplane Co., Renton, Wash.

4:00 Use of Modern Computers for Structural Problems

RAY W. CLOUGH, A.M. ASCE, Prof., Univ. of Calif., Berkeley.

Waterways and Harbors Division

2:30 p.m. Boston Room

Navigation and Flood Control Facilities and Budocks—Navy Department

Presiding: Lewis C. Coxe, Chairman, Executive Committee, Waterways and Harbors Division

2:30 Effects of Modern Weapons Systems on Naval Waterfront Facilities

M. W. KEHART, M. ASCE, CEC, USN, Director, Atlantic Div., Bur. of Yards and Docks, Navy Dept.

3:00 Graving Docks for Navy Super Carriers

JAMES R. AYERS, M. ASCE, Consultant, Waterfront Structures; and RALPH C. STOKES, Asst., Waterfront Structures, Bur. of Yards and Docks, Navy Dept., Washington, D. C.

3:30 Contractor's Planning for Navigation Locks

FRANK J. LARKIN, A.M. ASCE, Plant Engr., Contracting Div., Dravo Corp., Pittsburgh, Pa.

4:00 Current Aspects of New England Flood Control

ALDEN K. SIBLEY, Div. Engr., U. S. Army, Eng. Div., New England.

TECHNICAL DIVISIONS LUNCHEON

Tuesday, Oct. 15

12:15 p.m. Georgian Room

Arranged and Conducted by Technical Divisions

Presiding: FRANK A. MARSTON, Vice President, ASCE; Chairman, Committee on Division Activities.

Speaker: ROBERT MOSES, Chairman, New York State Power Authority, and N. Y. Commissioner of Parks.

Subject: The St. Lawrence and Niagara Power Projects (with comments on arterial highway progress in Metropolitan New York).

For this function, of general concern to all engineers, all members, guests and friends of the Society are invited.

Per plate $4.75. Tickets for this event must be purchased before 10:00 a.m. on Tuesday.

CONSULTANTS' DINNER

Tuesday, Oct. 15, Waldorf-Astoria Hotel

Annual Dinner of American Institute of Consulting Engineers

6:15 p.m. Cocktails Empire Room

7:15 p.m. Dinner Sert Room

Presiding: EDWARD H. ANSON, President, American Institute of Consulting Engineers.

Speaker: RAYMOND A. WHEELER, U.S.A., United Nations Suez Canal Clearance Group, United Nations, New York, N. Y., and International Bank for Reconstruction and Development, Washington, D. C.

Award of Merit Recipient: DONALD A. QUARLES, The Deputy Secretary of Defense, Washington, D. C.

Cost per person: $17.50.

Engineers who wish to attend may address inquiries about tickets to: American Institute of Consulting Engineers, 33 West 39 St., New York 18, N. Y.

WEDNESDAY MORNING

OCT. 16

Annual Business Meeting of ASCE

10:30 a.m. Georgian Room

Presiding: Mason G. Lockwood, President of ASCE

10:30 Annual Reports

By the President

By the Executive Secretary

11:00 Presentation of Awards

Norman Medal to Alfred M. Freudenthal, M. ASCE, Prof. of Civil Eng., Columbia Univ., New York, N. Y.

J. James R. Croes Medal to William E. Wagner, M. ASCE, Hydraulic Engr., U. S. Bur. of Reclamation, Denver, Colo.

Thomas Fitch Rowland Prize to John Wood Clark, J.M. ASCE, Research Engr.; Ernest C. Hartmann, M. ASCE, Asst. Director of Research; and Harry N. Hill, M. ASCE, Asst. Chief Engr. of Design, Aluminum Co. of America.

James Laurie Prize to Glenn B. Woodruff, M. ASCE, Consulting

Engr., San Francisco, Calif.; and Walter L. Dickey, M. ASCE, Chief Civil and Structural Engr., Bechtel Corporation, San Francisco, Calif.

Arthur M. Wellington Prize to Wesley G. Holtz, M. ASCE, Head, Earth Materials Lab.; and Harold J. Gibbs, A.M. ASCE, Engr., Earth Materials Lab., U. S. Bur. of Reclamation, Denver, Colo.

Collingwood Prize for Junior Members to George E. MacDonald, A.M. ASCE, Vice President, Lockwood, Kessler & Bartlett, Inc., Syosset, New York.

Construction Engineering Prize (Construction Div.) to John N. Newell, M. ASCE, Chief Engr., Kansas City Bridge Co., Kansas City, Mo.

Karl Emil Hilgard Hydraulics Prize (Hydraulics Div.) to Donald Ross, Technical Staff, Bell Telephone Labs., Whippany, N. J.

J. C. Stevens Award (Hydraulics Div.) to Neal E. Minshall, A.M. ASCE, Research Project Supervisor, SCS, Madison, Wis.

James W. Rickey Medal (Power Div.) to Claudio Marcello, M. ASCE, Construction Engr. and Technical Director, Societa Edison, Milano, Italy; and Carlo Semenza, M. ASCE, Central Manager and Chief Engr., Hydraulics Construction Dept., Societa Adriatica di Elettricita, Venice, Italy.

Rudolph Hering Medal (Sanitary Eng. Div.) to Norman H. Brooks, J.M. ASCE, Asst. Prof. of Civ. Eng.; Alfred C. Ingersoll, M. ASCE, Asst. Prof. of Civ. Eng.; and Jack E. McKee, M. ASCE, Prof. of Sanitary Eng., Calif. Inst. of Tech., Pasadena, Calif.

Thomas A. Middlebrooks Award (Soil Mechanics and Foundations Div.) to John A. Focht, Jr., A.M. ASCE, McClelland Engineers, Houston, Tex.; and Charles I. Mansur, M. ASCE, Miss. River Commission, Vicksburg, Miss.

Ernest E. Howard Award (Structural Div.) to William E. Dean, Jr., M. ASCE, Engr. of Bridges, State Road Dept., Tallahassee, Fla.

Leon S. Moisseiff Award (Structural Div.) to David J. Peery, M. ASCE, Aeronautical Engr., Univ. of Michigan, Ann Arbor.

11:30 Installation of Officers
Report of Tellers on Ballot Canvass
Installation of Directors
Installation of Vice Presidents
Installation of President
President's Keynote Address

12:00 Adjournment for Awards Luncheon

AWARDS LUNCHEON

Wednesday, Oct. 16

12:15 p.m. Ballroom

Program arranged with cooperation of the Highway Division

Presiding: Louis R. Howson, President ASCE.

Toastmaster: Barclay G. Johnson, M. ASCE; Chairman, New York Annual Convention Committee.

Speaker: Bertram D. Tallamy, M. ASCE; Federal Highway Administrator, Washington, D. C.

Subject: The Engineer's Biggest Challenge.

Honorary Membership Awards: Presented by Mason G. Lockwood, Past President ASCE, to:

Lorenzo Perez Castro, M. ASCE, Construction Engr., Nacional Financiera, SA, Mexico City.

Whitney C. Huntington, M. ASCE, Prof. of Civil Eng. (retired), Univ. of Illinois, Urbana.

Karl Imhoff, M. ASCE, Consulting Engr., Robert Schmidt, Essen, Germany.

Howard S. Morse, M. ASCE, Indianapolis Water Co., Indianapolis, Ind.

All members of ASCE, their wives, guests and friends, are cordially invited to attend.

Per plate $4.75. Tickets for this luncheon must be purchased before 10:00 a.m. on Wednesday.

WEDNESDAY AFTERNOON

OCT. 16

Construction Division

2:30 p.m. **Dallas Room**

Presiding: Walter L. Couse, Member, Executive Committee, Construction Div.

2:30 Chase Manhattan Bank Foundations
Chester W. Cambell, President, The Foundation Co., New York.

3:00 The New Staten Island Ferry Terminal
David P. Billington, J.M. ASCE, Roberts and Schaefer Co., New York.

3:30 Discussion

Engineering Mechanics and Structural Divisions, Joint Session

2:30 p.m. **Washington Room**

Blast Forces

Presiding: Merit P. White, Secretary, Executive Committee, Engineering Mechanics Division, and Leo H. Corning, Vice Chairman, Executive Committee, Structural Division

2:30 Blast Phenomena
Ferd E. Anderson, Jr., A.M. ASCE, CE, USA, Armed Forces Special Weapon Project, Pentagon, Washington, D. C.

3:00 Blast Loading on Structures
H. L. Murphy, M. ASCE, CEC, USNR, Director, Passive Defense Div., Bur. of Yards and Docks, Navy Dept., Washington, D. C.

3:30 Design and Analysis of Structures under Blast Loadings
N. M. Newmark, M. ASCE, Head, Dept. of Civil Eng., Univ. of Illinois, Urbana.

4:00 Evolution of Design Concepts for Resistance to Blast Forces as Affected by Increased Capabilities of Weapons
A. Amirikian, M. ASCE, Consultant, Special Structures Branch, Bur. of Yards and Docks, Navy Dept., Washington, D. C.

Highway Division

2:30 p.m. **Ivy Room**

New Developments in Traffic Engineering

Presiding: Wilbur Smith, Chairman, Committee on Traffic Engineering, Highway Division

2:30 Continuous Sampling as a Technique in Origin and Destination Studies
S. T. Hitchcock, Chief, Div. of Highway Transport Research, Bur. of Public Roads, Washington, D. C.

3:00 Correlation of Geometric Design and Directional Signing
George Webb, A.M. ASCE, Traf-

fic Engr., Calif. Div. of Highways, Sacramento.

3:30 Creating a Better Understanding of Traffic Engineering
DONALD McNEIL, M. ASCE, Consulting Engr., Pittsburgh, Pa.

4:00 Ground Transportation Facilities at New York International Airport
RICHARD I. STRICKLAND, Asst. Chief, Traffic Engineering, The Port of New York Authority, New York.

Hydraulics Division

2:30 p.m. West Room

Sponsored by Committee on Research

Presiding: Carl E. Kindsvater, Member, Executive Committee, and Frank B. Campbell, Chairman, Research Committee, Hydraulics Division

2:30 Introductory remarks
J. M. ROBERTSON, M. ASCE, Prof., Dept. of Theoretical and Applied Mechanics, College of Eng., Univ. of Illinois, Urbana.

2:45 Turbulence Characteristics of the Hydraulic Jump
HUNTER ROUSE, M. ASCE, Director, Iowa Inst. of Hydraulic Research, State Univ. of Iowa, Iowa City.

3:15 Development of the Turbulent Boundary-Layer in a Conical Diffuser
HARVEY R. FRASER, Colonel, USA, Prof. of Mechanics, U. S. Military Academy, West Point.

3:45 Laminar-Turbulent Transition in Pipe Flow
M. R. CARSTENS, A.M. ASCE, Prof. of Civil Eng., Georgia Inst. of Technology.

4:15 European Laboratory Practice
LAWRENCE C. NEALE, M. ASCE, Asst. Director, Alden Hydraulic Lab., Worcester Polytechnic Inst., Worcester, Mass.

Sanitary Engineering Division

2:30 p.m. East Room

Industrial Waste and Water Supply

Presiding: Arthur D. Caster, Secretary, Executive Committee, Sanitary Engineering Division

2:30 Recent Contributions by Research to Sanitary Engineering
NELSON NEMEROW, A.M. ASCE, Prof. of Sanitary Eng., N. C. State College, Raleigh, N. C.

3:15 Gas Transfer to and from Aqueous Solutions
THOMAS R. CAMP, M. ASCE, Camp, Dresser and McKee, Boston, Mass.

4:00 U. S. Public Health Service Quality, Basic Data Program
RALPH PALANGE, A.M. ASCE, Asst. Chief, Water Supply and Water Pollution Control Program, U. S. Public Health Service, Cincinnati, Ohio.

Waterways and Harbors Division

2:30 p.m. Hartford Room

Sponsored by Committee on Coastal Engineering

Presiding: Lewis C. Coxe, Chairman, Executive Committee, Waterways and Harbors Division

2:30 Laboratory Study of Effects of Roughness and Permeability on Wave Run-up on Slopes
RUDOLPH P. SAVAGE, Research Engr., Beach Erosion Board, Corps of Engineers, Washington, D. C.

3:00 Model Study of Wave Refraction
R. L. WIEGEL, Research Engr., Univ. of Calif., Berkeley.

3:30 Stability of Coastal Inlets
PER BRUNN, Coastal Eng. Lab., Univ. of Florida, Gainesville.

STUDENT CHAPTER CONFERENCE

Wednesday, Oct. 16

2:30 p.m. Georgian Room

Presiding: Marc Caspe, Chairman, Metropolitan Student Chapter Conference, The City College of New York

3:30 Introduction of Chapter Representatives

2:40 President's Address
LOUIS R. HOWSON, President, ASCE.

3:00 Welcoming remarks
JOSEPH S. WARD, Chairman, Subcommittee on Student Activities, Annual Convention Committee.

3:10 Opportunities on Graduation, a panel discussion

(a) Attending Graduate School
JEWELL M. GARRELTS, Director, ASCE, Dept. of Civil Eng., Columbia Univ., New York.

(b) Working for a Firm Employing a Small Number of Engineers.
M. D. MORRIS, M. ASCE, Vice President, Test Lab Corp., New York, N. Y.

(c) Working for a Firm Employing a Large Number of Engineers.
ALFRED L. PERLMAN, President, New York Central Railroad, New York, N. Y.

Dinner-Dance and Reception

Wed., Oct. 16 **Ballroom Suite**

6:30 p.m. Assembly and cocktails in Ballroom Rotunda

Cocktails provided through the hospitality of the Metropolitan Section, ASCE.

7:30 p.m. Dinner in Ballroom

9:00 p.m. Reception by President and Honorary Members in East Room

9:00 p.m. Dancing in Ballroom

Dinner music, dance music and entertainment provided by the Stanley Melba Orchestra.

For this social evening, special reservation can be made for tables seating 10 persons each. Members may underwrite complete tables, or pool reservations with others.

The published seating list will close at 2:00 p.m., Tuesday, Oct. 15. Tickets purchased after that hour will be assigned to tables in order of purchase. Sale of tickets will be limited to the capacity of the Ballroom.

Dinner dress (black tie). Per plate $10.00.

Mail orders for tables must be accompanied by a check in full, and a list of guests. Send order and checks to:

American Society of Civil Engrs.
33 West 39 Street
New York 18, N. Y.

THURSDAY MORNING

OCT. 17

Construction, Highway, Structural Divisions, Joint Session

9:30 a.m. Ivy Room

Current Developments in Metropolitan-New York Arterial Highway System

Presiding: E. S. Olcott, Member, Committee on Session Programs, Highway Division; and E. Timby, Secretary, Executive Committee, Structural Division

9:30 New Techniques in Precast and Prestressed Concrete in Approaches to Lincoln Tunnel's Third Tube
FREDERICK C. LOWY, M. ASCE, Consulting Engr., New York.

10:00 Resurfacing the Jersey City Underpass
J. C. REED, Supervising Engr., Materials Lab., N. J. State Highway Authority.

10:30 Construction of Cross-Bronx Expressway in Highly Urbanized Area
MILTON E. GOUL, District Eng., N. Y. State Dept. of Public Works, Babylon, L. I.

11:00 Design Features of Lower Deck on George Washington Bridge
IRVING P. GOULD, M. ASCE, Engr. of Design, Port of New York Authority, New York.

Engineering Mechanics, Waterways and Harbors Divisions, Joint Session

9:30 a.m. Washington Room

Presiding: W. D. Baines, Head, Hydraulics Lab., National Research Council, Canada

9:30 Forces on Vertical Cylinders in Shallow-Water Waves
DONALD R. F. HARLEMAN, A.M. ASCE, Assoc. Prof. of Hydraulics; and WILLIAM C. SHAPIRO, J.M. ASCE, Research Asst., Hydrodynamics Lab., Mass. Inst. of Tech., Cambridge.

10:00 Vortex Shedding and Resistance in Unsteady Flow
JOHN S. MCNOWN, M. ASCE, Dean, School of Eng. and Architecture, Univ. of Kansas, Lawrence, Kans., and GARBIS H. KEULEGAN, Univ. of Mich., Ann Arbor.

10:30 Forces Induced on the Moored U.S.S. Norton Sound by Waves in Port Hueneme, Calif., during 1954
J. T. O'BRIEN, A.M. ASCE, Director, Waterfront Structures Div.; and P. I. KUCHENREUTHER, U. S. Naval Civil Eng. Research and Evaluation Lab., Port Hueneme, Calif.

11:00 Ship Mooring-Line Forces Induced by Waves
R. L. WIEGEL, Research Engr., Univ. of Calif., Berkeley.

Hydraulics, Waterways and Harbors Divs., Joint Session

9:30 a.m. West Room

Sponsored by Committee on Tidal Hydraulics, Hydraulics Division

Presiding: Carl E. Kindsvater, Member, Executive Committee; and Joseph M. Caldwell, Chairman, Committee on Tidal Hydraulics, Hydraulics Division

9:30 Passamaquoddy Tidal Power Study
LINCOLN REID, Hydraulic Engr., USA Engr. Div., New England, Boston, Mass.

10:00 Tidal Movement in Cape Cod Canal
B. W. WILCOX, U. S. Coast and Geodetic Survey, Washington, D. C.

10:30 Closure of Breach in Baycean Peninsula, Tillamook Bay, Oregon
G. R. CLARK, R. J. POPE, and H. E. BROWN, USA Engineer District, Portland, Ore.

Power Division

9:30 a.m. Hartford Room

Civil Engineering Aspects of Thermal Plants

Presiding: G. H. Von Gunten, Chairman, Committee on Progress in Power Plant Design, Power Division

9:30 Underground Plants in Italy with Special Reference to S.A.D.E. and Montecatini Power Stations
CARLO SEMENZA, M. ASCE, Chief Engr., Hydraulic Construction Dept., S.A.D.E., Venice; and DANTE FINZI, Chief Engr., Hydroelectric Constr. Dept., Montecatini, Milan.

10:00 Haas Underground Power Plant
J. BARRY COOKE, A.M. ASCE, Senior Civil Engr., Pacific Gas and Electric Co.

10:30 Underground Power Plants in Yugoslavia
V. YEVDJEVIC, M. ASCE, Director, Inst. of Hydraulic Eng., Yugoslavia.

11:00 Discussion

Soil Mechanics and Foundations Division

9:30 a.m. East Room

Presiding: Ralph E. Fadum, Vice Chairman, Executive Committee, Soil Mechanics and Foundations Division

9:30 Geologic Soil Provinces in New York Area
GIRARD WHEELER, Vice President, Giles Drilling Corp., New York.

10:00 Discussion
MARTIN S. KAPP, J.M. ASCE, Soils Engr., Port of New York Authority, New York.

10:15 Foundation Aspects of New York's Glacial Lake Formation
JAMES D. PARSONS, M. ASCE, Associate, Moran, Proctor, Mueser & Rutledge, New York.

10:45 Discussion
GORDON F. A. FLETCHER, M. ASCE, Asst. Vice President, Raymond Concrete Pile Co., New York.

11:00 Soils of Newark Metropolitan Area of New Jersey
ALFREDS R. JUMIKIS, M. ASCE, Prof. of Civil Eng., Rutgers Univ., New Brunswick, N. J.

11:30 Discussion
DAVID M. GREER, M. ASCE, President, Greer Eng. Assocs., Montclair, N. J.

TECHNICAL DIVISION LUNCHEON

12:15 p.m. Georgian Room

Sponsored Jointly by Engineering Mechanics, Soil Mechanics and Foundations, and Structural Divisions

Speaker: ROBERT H. MEADE, M. ASCE, Rear Admiral, CEC, U. S. Navy, Chief of Civil Engineers.

All members, guests and friends of ASCE are invited to attend and take part in this event devoted to one of the important engineering problems of the day.

Per plate $4.75. Tickets must be purchased before 10:00 a.m. on Thursday.

THURSDAY AFTERNOON OCT. 17

Construction Division

2:30 p.m. Dallas Room

Presiding: Warren N. Riker, Vice Chairman, Executive Committee, Construction Division

2:30 Construction Financing
W. C. Bloom, Controller and Asst. Treasurer, Raymond Concrete Pile Co., New York.

3:00 Bidding and Estimating Heavy Construction Projects
Eugene Rau, M. ASCE, Vice President and Chief Engr., J. Rich Steers, New York.

3:30 Discussion

Hydraulics Division

2:30 p.m. West Room

Sponsored by Committee on Sedimentation

Presiding: Carl E. Kindsvater, Member, Executive Committee; and Fred H. Larson, Chairman Committee on Sedimentation, Hydraulics Division

2:30 Introductory remarks
Samuel Shulits, Chairman, Task Force on Sediment Distribution in Reservoirs.

2:35 Effects of Velocities on Reservoir Sediment Distribution
J. B. Stall, A.M. ASCE, Assoc. Engr., State Water Survey Div., Urbana, Ill.

3:05 Distribution of Sediment in Large Reservoirs
Whitney M. Borland, A.M. ASCE, Head Engr.; and Carl R. Miller, A.M. ASCE, Hydraulic Engr., Sedimentation Sect., U. S. Bur. of Reclamation, Denver, Colo.

3:35 Introductory remarks
Herbert E. Hudson, Jr., Chairman, Task Force on Rates of Reservoir Sedimentation.

3:40 Behavior of Sediment in Reservoirs, Trap Efficiencies
Walter J. Wood, A.M. ASCE, Assist. Chief, Hydraulics Div., Los Angeles County Flood Control Dist.; and Charlie M. Moore, A.M. ASCE, Head, Eng. Design Sect., Eng. and Watershed Planning Unit, U. S. Dept. of Agriculture, Soil Conservation Service, Ft. Worth, Tex.

4:10 Behavior of Sediment in Reservoirs—Densities and Compaction Rates
Victor Koelzer, A.M. ASCE, Harza Eng. Co., Chicago, Ill.; and Joe M. Lara, Hydraulic Engr., U. S. Bur. of Reclamation, Denver, Colo.

HIGHWAY DIVISION FIELD TRIP

Thurs. afternoon, Oct. 17

At 2:00 p.m. sharp, buses will depart from the Statler Hotel for an inspection of parts of New York's arterial highway system under construction and planned. Buses will return approximately at 5 p.m.

This tour will include an inspection of completed sections of the Brooklyn-Queens Expressway on the Interstate Highway System, as well as parts of this expressway currently under construction; parts of the Horace Harding Expressway currently under construction; the site of the proposed Throgs Neck Bridge between the Bronx and Queens; parts of the completed section of the Cross-Bronx Expressway and those sections under construction; the recently completed Major Deegan Expressway; the site of the expanded approaches for the lower level of the George Washington Bridge; and the recently completed third tube of the Lincoln Tunnel and its expressway approaches in Manhattan.
Price per person, $1.25.

Engineering Mechanics, Structural, Waterways and Harbors Divisions, Joint Session

2:30 p.m. Ivy Room

Wave Forces and Earthquake Forces

Presiding: Warren Raeder, Chairman, Executive Committee, Structural Div.

2:30 Selection of Design Wave
Charles Bretschneider, A.M. ASCE, Research Engr., Beach Erosion Board, Washington, D. C.

3:00 Wave Pressures on Submerged Structures
E. F. Brater, M. ASCE; J. S. McNown, M. ASCE; and Leslie B. Stair, Univ. of Mich., Ann Arbor.

3:30 Sturctural Dynamics in Earthquake Resistant Design
John A. Blume, M. ASCE, Engr., Standard Oil Co. of Calif., San Francisco.

4:00 Earthquake Design Criteria for Stack-Like Structures
John E. Rinne, M. ASCE, Civil and Structural Engr., Standard Oil Co. of California.

Power Division

2:30 p.m. Hartford Room

Civil Engineering Aspects of Thermal Plants

Presiding: Adolph J. Ackerman, Chairman, Education Task Committee, Power Division

2:30 Underground Power Plants of the Edison Co., Milan, Italy
Claudio Marcello, M. ASCE, Consulting Engr. and Technical Director, The Edison Co.

3:00 Underground Power Plants in Canada
A. W. F. McQueen, M. ASCE, President, H. G. Acres & Co.

3:30 Discussion

4:00 T. I. Underground Power Plant
Thomas A. Long, A.M. ASCE, Asst. Commissioner, Snowy Mountains Hydroelectric Authority, Alexandria, N.S.W., Australia.

Soil Mechanics & Foundations Division

2:30 p.m. East Room

Presiding: Ralph B. Peck, Chairman, Executive Committee, Soil Mechanics and Foundations Division

Sponsored by the Committee on Earth Dams, Soil Mechanics and Foundations Div.

2:30 Field Measurements on Willard Test Dam Embankment
W. W. Daehn, A.M. ASCE, Supervisory Civil Engr.; and E. E. Esmiol, A.M. ASCE, Civil Engr., Earth Dam Design Sect., U. S. Bur. of Declamation, Denver.

3:00 Discussion

3:15 Seepage Under Dams on Stratified Foundations
Paul H. Shea, A.M. ASCE, Foundations and Materials Branch; and H. E. Whitsett, Mathematician, Jacksonville Dist., Corps of Engineers, Jacksonville, Fla.

3:45 Discussion

4:00 Design and Performance of Vermilion Dam

KARL TERZAGHI, Hon. M. ASCE, Consulting Engr., Winchester, Mass.; and THOMAS M. LEPS, A.M. ASCE, Chief Civil Engr., Southern Calif. Edison Co., Los Angeles.

4:30 Discussion

MEN'S SMOKER AND SHOW

Thursday, Oct. 17

8:00 p.m. Ballroom

A gala evening for informal sociability, excellent entertainment, refreshments to suit a man's palate, and the chance to chat with friends and business associates—this is the reputation well earned by the smoker.

8:00- 9:00 p.m. Warm up

9:00-10:00 **Best of acts from current Broadway and TV shows**

10:00-closing **Sandwiches, snacks, beer and coffee, with bar service.**

Note: On this night out, wives are being entertained elsewhere and will not return until after the smoker.

Per person, $3.75.

FRIDAY MORNING OCT. 18

Hydraulics Division

Sponsored by Committee on Hydrology, Hydraulics Div.

Presiding: Carl E. Kindsvater, Member Executive Committee; and Herbert S. Riesbol, Chairman, Committee on Hydrology, Hydraulics Division

9:30 Land Subsidence due to Ground-Water Development in California

J. F. POLAND, Research Geologist, Ground Water Branch, U. S. Geological Survey, Sacramento.

10:00 Graphical Flood Routing and Related Mechanical Analogs

MAX KOHLER, A.M. ASCE, Chief, Research Hydrology, U. S. Weather Bur., Washington, D. C.

10:30 Areal Determinations of Stream Flow

M. T. THOMSON, M. ASCE, District Engr., Surface Water Branch, U. S. Geological Survey, Atlanta, Ga.

Power and Construction Divisions, Joint Session

9:30 a.m. Hartford Room

Civil Engineering Aspects of Thermal Plants

Presiding: G. J. Vencill, Retiring Chairman, Executive Committee, Power Div.

9:30 Ambuklao Underground Power Station

A. EBERHARDT, A.M. ASCE, Head Civil Engr., Harza Eng. Co.

10:00 Montgomery Dam, Colo.—Rockfill with Asphaltic Deck

F. W. SCHEIDENHELM, M. ASCE; JOHN B. SNETHLAGE, M. ASCE; and ARTHUR N. VANDERLIP, M. ASCE; Consulting Engrs., New York.

10:30 The Sudagai Underground Power Plant, Japan

T. MIZUKOSHI and S. MIMURA, Civil Engineers, Tokyo Electric Power Co., Tokyo, Japan.

11:00 Discussion

Soil Mechanics and Foundations Division

9:30 a.m. East Room

Report on Fourth International Conference on Soil Mechanics and Foundations Engineering

Presiding: Arthur Casagrande, Prof. of Soil Mechanics, Harvard Univ., Cambridge, Mass.

9:30 Soil Properties and Their Measurement

G. A. LEONARDS, A.M. ASCE, Assoc. Prof. of Soil Mechanics, Purdue Univ., Lafayette, Ind.

9:55 Techniques of Field Measurement and Sampling

J. O. OSTERBERG, A.M. ASCE, Prof. of Civil Eng., Technology Inst., Northwestern Univ., Evanston, Ill.

10:20 Foundations of Structures

P. C. RUTLEDGE, M. ASCE, Partner, Moran, Proctor, Mueser & Rutledge, New York.

10:45 Roads, Runways and Rail-Tracks

O. J. PORTER, M. ASCE, Porter, Urquhart, McCreary and O'Brien, Newark, N. J.

11:10 Earth Pressure on Structures and Tunnels

R. B. PECK, M. ASCE, Research Prof. of Civ. Eng., Univ. of Ill., Urbana, Ill.

11:35 Earth Dams, Slopes and Open Excavations

F. C. WALTER, M. ASCE, Head, Earth Dams Section U. S. Bur. of Reclamation, Denver, Colo.

FACULTY ADVISERS' CONFERENCE

Friday, Oct. 18

9:00 a.m. Dallas Room

Sponsored by ASCE Committee on Student Chapters

Presiding: Charles E. Clarridge, Chairman, Committee on Student Chapters

Faculty Advisers to 43 ASCE Student Chapters in the Northeast and Middle Atlantic States will convene on invitation to discuss Chapter activities. This all-day conference, while primarily for Faculty Advisers, is open to any and all who may be interested.

WATERWAYS AND HARBORS DIVISION CONFERENCE

at Princeton University

Planned and Conducted by ASCE Waterways and Harbors Division and the School of Engineering, Princeton University

Transportation by Pennsylvania Railroad leaves Pennsylvania Station at 8:30 a.m. on "The President." Breakfast served on the train. Arrival in Princeton at 9:30 a.m. Luncheon at the Princeton Inn as guests of Princeton University.

10:00 Planning of Elizabeth Port Authority Development

GUY F. TOZZOLI, Manager, Marine Terminals Dept. (Planning Div.), Port of N. Y. Authority.

10:30 Design of Waterfront Structures for Varying Site and Condition Requirements

WILLIAM C. STEVENS, Asst. to Engr. of Design, Design Div., Eng. Dept., Port of N. Y. Authority.

11:00 Stabilization of Marginal Lands for Marine Terminal Facilities

MARTIN S. KAPP, Soils and Foundation Engr., Materials Div., Eng. Dept., Port of N. Y. Authority.

11:30 New Trends in Anchored Bulkhead Design Based on Field Measurements

GREGORY P. TSCHEBOTARIOFF, Prof. of Civil Eng., Princeton Univ.; and MARTIN S. KAPP, Soils and Foundation Engr., Materials Div., Eng. Dept.

GENERAL CONVENTION EXCURSION

Friday, Oct. 18

Inspection of New York International Airport

At 1:00 p.m. sharp, buses will depart from the 32nd Street door of the Statler Hotel. As guests of the Port of N. Y. Authority, a conducted tour of New York International Airport will be enjoyed by ASCE members and their families. Among the points of unusual interest are the new International Arrivals Building, a conventional-type hangar actually under construction, and mechanical facilities, including air-conditioning and heating systems.

Buses will return at 5:00 p.m.

The Port of New York Authority, as hosts for this occasion, have underwritten all costs for this tour. Tickets may be obtained without charge prior to 4:00 p.m. Thursday, at the Registration Desk

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained in the Mezzanine Foyer of the Hotel Statler throughout the days of the Convention. Mail and messages will be held for members at the Information Desk.

PRESS ROOM

Sutton Room

For the convenience of the technical press, newspapers and radio, a press room will be open throughout the days of the Convention.

WOMEN'S HOSPITALITY ROOM

Empire Suite **First Floor**

The Hospitality Room will be the gathering place of all ladies attending the Convention. It will be open from 2:00 to 5:00 p.m. on Sunday, Oct. 13, and 9:00 to 5:00 on each Convention day, Monday through Thursday. Hostesses will be in attendance to arrange tours and special events of interest, and to answer questions about facilities of the Convention and the City of New York.

LADIES PROGRAM

An attractive variety of events has been scheduled for the entertainment of the ladies attending the Convention. Breakfast and coffee hour are planned for each morning. A list of available trips with directions will be posted in the Ladies Hospitality Room, where tickets for radio and television studios will also be available.

Monday, Oct. 14

A program of cinemascope color slides on "New York Has Everything" will be presented by the New York Telephone Company from 10:00 a.m. to 11:00 a.m. at the Statler. No charge. At 11:45 a.m. buses will leave for a "get-acquainted luncheon" at historic Fraunces Tavern in downtown New York. The buses will pass by major points of interest in Manhattan. $5.00 per person.

Tuesday, Oct. 15

Buses will leave the Hotel at 9:30 a.m. for Princeton for a visit to Princeton University and the Governor's Mansion. Luncheon will be served at the Princeton Inn. $5.00 per person.

Wednesday, Oct. 16

Guided tours of the United Nations Building and of the famous New York museums will be available during the morning. No charge.

Thursday, Oct. 17

A fashion show in the Empire Room of the Waldorf-Astoria by one of New York's nationally-known stores will follow the 12:30 luncheon at that hotel. $5.00 per person. Old-time movies featuring Rudolph Valentino will be shown in the Sky Top at the Statler at 8:00 p.m. No charge.

Separate detailed programs for the ladies will be available, with a complete listing of all other Convention events of special interest to them.

TOP PLAYS ON BROADWAY

This list is presented for your convenience only. Prices quoted are for weekday evenings.

New Girl in Town 8:30 p.m.
46 St. Theater, 226 West 46 St. $8.60, 8.05, 6.90, 6.00, 5.00, 4.60, 3.50, 3.00

No Time for Sergeants 8:40 p.m.
Alvin Theater, 25 West 45 St. $4.60, 4.10, 3.45, 2.95, 2.30

The Tunnel of Love 8:40 p.m.
Royale Theater, 242 West 45 St. $6.75, 4.80, 4.05, 3.60, 3.00, 2.50

A Visit to a Small Planet 8:40 p.m.
Booth Theater, 222 West 45 St. $4.80, 3.60, 3.00

Li'l Abner 8:30 p.m.
St. James Theater, 246 West 44 St. $8.05, 6.90, 4.80, 3.60, 3.00, 2.30

The Most Happy Fella 8:30 p.m.
Imperial Theater, 249 West 45 St. $7.50, 6.25, 4.95, 4.30, 3.60, 3.00, 2.50

Bells Are Ringing 8:30 p.m.
Shubert Theater, 234 West 44 St. $8.05, 6.90, 5.75, 4.95, 3.45, 2.90

Damn Yankees 8:30 p.m.
Adelphi Theater, 152 West 54 St. $7.50, 5.75, 4.60, 3.45, 2.30

Happy Hunting 8:30 p.m.
Majestic Theater, 245 West 44 St. $8.05, 6.90, 5.20, 3.60, 3.00, 2.50

My Fair Lady 8:30 p.m.
Mark Hellinger Theater, 238 West 51 St. $8.05, 7.50, 6.90, 5.75, 4.60, 3.45, 2.30

Long Day's Journey Into Night 7:30 p.m.

Helen Hayes Theater, 210 West 46 St. $6.90, 5.75, 4.60, 4.05, 3.45, 2.90

Mail orders directly to the theater. ASCE cannot make reservations.

SESSIONS OF THE BOARD

The ASCE Board of Direction will be in session, in the Washington Room, at the following times:

Monday, Oct. 14, 9:00 a.m. to 5:00 p.m.

Tuesday, Oct. 15, 9:00 a.m. to 5:00 p.m.

Thursday, Oct. 17, 2:30 p.m.

CHI EPSILON

Members of Chi Epsilon, their families and guests—men and women—will have their 23rd Annual Luncheon at 1:00 p.m., Thursday, October 17, 1957. For reservations and further information talk to or write to Harold T. Larsen at Society Headquarters (phone, PE 6-9220). Luncheon will be over in time to permit attendance at the afternoon affairs of the Convention.

UNIVERSITY OF ILLINOIS DINNER

The University of Illinois Civil Engineering Alumni and their friends will meet for their 30th annual informal dinner on Thursday evening, October 17, 1957. For reservations and further information, talk to, or write to, Harold T. Larsen at Society Headquarters (phone, PE 6-9220). Ladies are invited. Dinner will be over in time to permit attendance at the evening events of the Convention. This will be a wonderful chance to pay our respects to Professor Huntington on his election to honorary membership in the Society.

RUTGERS UNIVERSITY ENGINEERING ALUMNI

Rutgers Civil Engineering alumni will hold their Seventeenth Annual Dinner Meeting on Thursday evening, Oct. 17, at the Old Timers Grill, 7 East 40th Street. Assembly will be at 6:00 p.m. and dinner at 6:30, sufficiently early to permit later attendance at the ASCE Smoker. Members of the faculty will report on plans for expansion at the college.

Requests for reservations should be mailed with check for $4.00 to R. L. Brandes, 101 Park Avenue, New York 17, N. Y.

M. I. T. DINNER

Thurs., Oct. 17 6:30 p.m.

M. I. T. will hold its Civil Engineering Dinner at the Biltmore Hotel. Cocktails at 6:30 p.m. will be served in the M. I. T. Club Headquarters. Dinner will follow in the Biltmore Room. Reservations, enclosing checks at $7.50 per person, should be addressed to Mr. A. E. Hittl, Room 1007, 30 East 42nd Street, New York, N. Y.

ANNUAL CONVENTION COMMITTEE

Barclay G. Johnson, *General Chairman*
Thomas J. Fratar, *Vice Chairman*
John R. Zehner, *Past Chairman*
John P. Riley, *Board Contact*
Arthur J. Fox, *Metropolitan Section Contact*
Don P. Reynolds, *Secretary*

Awards Luncheon

Edward G. Wetzel, *Chairman;* George A. Burpee, John Robinson, Elmer K. Timby

Dinner-Dance

Gardner M. Reynolds, *Chairman;* Edward G. Wetzel, Malcolm Pirnie, Jr.

Division Luncheons

Elmer K. Timby, *Chairman;* Ronald B. Dillenbeck, Joseph S. Ward

Excursions

Michael N. Salgo, *Chairman;* Ronald B. Dillenbeck, John Robinson

Exhibits

E. Stuart Kirkpatrick

Hotel Arrangements

Thomas J. Fratar, *Chairman;* George A. Burpee

Kick-off Party

Malcolm Pirnie, Jr., *Chairman;* Donald D. King, Gardner M. Reynolds

Promotion and Attendance

Edward J. McGrew, Jr., *Chairman;* Donald D. King

Smoker

Carl A. Arenander, *Chairman;* Algert D. Alexis, Edward J. McGrew, Jr.

Student Activities

Joseph S. Ward, *Chairman;* Michael N. Salgo

Women's Committee

Mrs. Barclay G. Johnson, *Chairman*
Mrs. Thomas J. Fratar, *Vice-Chairman*
Mrs. John M. Zehner, *Past Chairman*
Mrs. Algert D. Alexis, Mrs. Carl A. Arenander, Mrs. David G. Baillie, Jr., Mrs. George A. Burpee, Mrs. E. Lawrence Chandler, Mrs. Ronald B. Dillenbeck, Mrs. Arthur J. Fox, Jr., Mrs. Jewell M. Garrelts, Mrs. Clinton D. Hanover, Jr., Mrs. Richard Hazen, Mrs. Donald D. King, Mrs. E. Stuart Kirkpatrick, Mrs. Edward J. McGrew, Jr., Mrs. Enoch R. Needles, Mrs. Malcolm Pirnie, Jr., Mrs. Carlton S. Proctor, Mrs. Don P. Reynolds, Mrs. Gardner M. Reynolds, Mrs. John P. Riley, Mrs. Michael N. Salgo, Mrs. Elmer K. Timby, Mrs. Charles E. Trout, Mrs. Joseph S. Ward, Mrs. Edward G. Wetzel, Mrs. William H. Wisely.

THE READERS WRITE

Restudy use of highway consultants

To the Editor: Much discussion has resulted from the circular memorandum of December 28, 1956, issued by former Federal Highway Administrator Volpe on the "Employment of Consultants in the Federal-Aid Program." Happily this memorandum was amended by another on July 3, 1957, from present Administrator Tallamy.

Most of the discussion has centered on the policy established for employment of highway engineers presently on the staffs of governmental agencies. Relatively little attention has been given to the potentially more significant policies established concerning utilization of highway consulting firms. Mr. Volpe's memorandum implied that state agencies must eliminate the use of consultants if they are to "unquestionably comply with the basic provision of the law." This policy was softened by Mr. Tallamy's amendment which states that consultants may be employed "on occasion."

As a consultant, I do not pretend to objectivity in this matter, but it does seem legitimate for all consultants to be interested in an official policy which so vitally concerns their future welfare. With the prospect of vastly increased highway activity under the Federal-Aid Highway Act of 1956, now would seem to be an appropriate time to reexamine the basic philosophy behind the provision of highway engineering services by state governmental agencies. That such services should normally be provided by state agencies has become widely accepted; no great furor has arisen concerning this aspect of the policy. But may we not ask ourselves how and why existing policies have been developed? Of even more basic importance, may we not inquire whether the performance of highway engineering services by state agencies is necessary and desirable?

Most highway engineers will agree that present practice has come about not so much as a result of calculated policy as a cumulatively compiled tradition based on procedures of expedience which were contrived to meet pressures in the ever growing highway industry. This practice continued until the engineering shortage of World War II and its aftermath forced a modification of it.

As to the question of necessity, it is a fact that a number of states have been using the services of consultants for periods of ten to fifteen years. Many others have adopted the practice in more recent years. If there existed any basic necessity for execution of engineering services by governmental agencies, it follows that consultants could not have been successfully used over so long a period. On the contrary, experience to date would indicate that the efficacy of

consultants' services will increase as state agencies gain experience in utilizing them, and the relationship between state and consultant becomes more firmly fixed. This has also proved true as it pertains to the use of private organizations for construction services.

The question of desirability is more controversial since it involves fundamental political policy. However, even here it seems safe to say that the fostering of private enterprise is not a partisan political issue in this country. It is a generally accepted American political principle that governments should not perform those functions which can be performed equally well by private agencies. Our state governments do not operate hospitals or dental clinics in competition with similar private institutions, nor do they provide legal services in competition with private law firms. Why then is it desirable for them to provide engineering services which are available from private organizations?

The use of consultants would not mean that state highway engineers would immediately lose their jobs. Several states are now using their entire staffs to administer the work of consultants and to perform their other governmental functions. This practice merits serious consideration as a fixed national policy and would involve no surrender of administrative or policy making responsibilities. It would in fact increase the executive duties of state highway engineers, thereby affording them the opportunity to justify and support the higher pay and professional status they deserve. Would this not be a true solution to the problem Mr. Volpe was trying to solve by administrative fiat?

Finally, such a policy would have the happy effect of reversing the seemingly irreversible process by which more and more activities are being transferred from private to governmental enterprise. I therefore suggest that our Federal Government restudy its policy with a view to the provision of service functions by private agencies and governmental functions by governmental agencies.

R. E. Smith, M. ASCE
Vice President
Capitol Engineering Corp.
Dillsburg, Pa.

Waterways—a federal responsibility

To the Editor: A report by the Board of Directors of the Engineers Joint Council entitled "Principles of a Sound National Water Policy—a Restatement," was published in the May issue.

Of interest in connection with the subject of federal flood control projects versus those undertaken by private organizations is the flood control project of the Miami Conservancy District, long lauded as an example of what can be done without federal aid. Local initiative in this case was certainly splendid and the project is an outstanding model of its kind.

It should be noted, however, that the area of Ohio is 69,283 sq miles and that of the Conservancy District about 4,000 sq miles, or about 5.7 percent of the state's area. Topographically the small Miami Valley is ideally suited for some measure of local flood control. But the flood water released from behind its retention dams soon gets into the Mississippi system. It must then be kept in bounds by federal protective works most of the way from the confluence of the Miami and Ohio Rivers to the Gulf of Mexico, more than 1,600 miles.

"No locality or state can take care of any large volume of flood water finally within its own borders." The great City of New Orleans is wholly protected by levees. Much of the flood water that it is protected from originates in the Miami Valley of Ohio and in countless other localities in the 31-state area all or partly drained by the Mississippi.

Under the subhead, "Federal Participation" (Civil Engineering, May 1957, p. 54), the EJC Board report states, in part:

"The development, ownership, operation, and maintenance of water resource projects should be kept as close as possible to those who use and benefit from them. To that end, those groups should be permitted, on a fair and equitable basis, to acquire title to and to operate and maintain projects constructed by the Federal Government."

In toto, such an arrangement with respect to harbors and channels is not possible. Ships enter, say, the Port of New Orleans from all over the world. Their cargoes are distributed through every state in the Union, as are cargoes reaching every other major port. When the new channel to the Gulf is completed, how would its cost be prorated among those who are benefited by it?

What local interests should pay for the improvement of New York Harbor and its channels, the development of the Delaware from Philadelphia to the sea and to Trenton, the Houston Ship Channel, the Mississippi from the Gulf to New Orleans and to St. Paul, the Hudson from New York to Albany, the San Joaquin and Sacramento from San Francisco to Stockton and Sacramento, the Willamette and Columbia from Portland to the Pacific? It is as impossible to prorate the cost of local benefits from federal harbor and channel improvements as it is to prorate the cost of local benefits from federal flood control works among localities from Ohio to the Gulf or any other area so aided.

Piers, wharves, elevators, warehouses, trackage and other necessary facilities are wholly the work of local authorities or private interests. The Federal Government improves only the waterways. The two are inseparable; one is utterly useless without the other. Local interests also often contribute to the cost of many harbor and channel improvements with cash, rights-of-way, and spoil areas for material dredged from waterways.

Government help for certain general-welfare purposes has been in practice since medieval times; it began in America with the birth of the nation. Taxpayers have contributed directly and indirectly to wagon trails, canals, harbor and channel improvements, railways and highways. Certain industries are helped through protective tariffs; science is helped in research and investigation. The shipping industry is subsidized.

What local interests would acquire title to the protective levees along that desolate but vital reach of the Mississippi from Helena, Ark., to Arkansas City, some 75 miles? A flood flow of more than two million cfs of water, originating in 31 states, has been taken care of in that stretch of the river six times since 1912.

The purpose of this federal aid is to encourage, protect and strengthen those activities that are not adaptable to private enterprise but are essential to the national welfare.

Nation-wide harbor and channel development and maintenance, wholly unsuited for private capital and impossible of prorating direct and indirect costs among the far-flung beneficiaries, is a duty and a responsibility of the Federal Government.

Harry O. Locher
Secretary and Treasurer,
The National Assoc. of River and Harbor Contractors
New York, N. Y.

Error in computer problem noted

To the Editor: In the article, "Electronic Computers Speed up Bridge Design," by Robert E. Shields and the writer, in the April 1957 issue, there is an error in the formula at the top of Fig. 1 (p. 61), where M_Y [shown below in bold face] was omitted from the numerator of the second term.

The formula should read:

$$\frac{P}{A}+\left[\frac{M_X-\frac{I_{XY}}{I_Y}\boldsymbol{M_Y}}{I_X-\frac{(I_{XY})^2}{I_Y}}\right]X_o+\left[\frac{M_Y-\frac{I_{XY}}{I_X}M_X}{I_Y-\frac{(I_{XY})^2}{I_X}}\right]Y_o=0$$

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SOCIETY NEWS

Fantastic Future for Prestressed Concrete Predicted at San Francisco Conference

An almost limitless future for prestressed concrete was envisaged by speakers at the recent World Conference on Prestressed Concrete held in San Francisco. In the keynote address William E. Dean, M. ASCE, assistant state highway engineer of Florida, stated that "accomplishments have earned for prestressed concrete a firm and well deserved place in American practice." While the past accomplishments of prestressed concrete design are spectacular, he added, "the future appears to be not only promising but almost fantastic in its potential."

Mr. Dean's address on Monday, July 29, led off a six-day conference, conducted by the University of California's Department of Engineering and the University Extension, with the cooperation of eleven organizations including the Structural Division of ASCE. The program offered more than seventy papers with discussions, motion pictures, and an exhibit of engineering materials and services related to prestressing. With the aim of pooling world information, the conference invited wide attendance and participation. The attendance of 1,200 represented nearly every state in the union and forty foreign countries—among them some nations with whom free exchange of information has been restricted in recent years.

The lengthy program was all too short to provide an outlet for all the new information in the fast-developing technique of prestressing. However, time was taken from seated sessions for two spectacular field trips. The first "eye-opener" was an all-day bus tour to two huge modern prestressing plants—the Ben C. Gerwick, Inc., plant at Petaluma and the plant of the Basalt Rock Co., Inc., at Napa, both with facilities for producing all manner of prestressed products including bridge girders. En route there was opportunity to view completed prestressed structures and others under construction. Another trip took in the Berkeley campus of the University of California and the laboratories there.

While the future of prestressing seemed assured to those attending the conference, they were cautioned by Mr. Dean that "the sharing of ideas must continue. It must be carried over to our technical societies . . . this sharing must be maintained in the fields of research and development. Thus far the practicing engineer, architect, and manufacturer have far outstripped the research programs and successfully. But if we are to progress, research must be fully organized and shared by all the societies. There is no place for rivalry or jealousy among technical societies."

Both Mr. Dean and San Francisco's Mayor George Christopher, who welcomed the engineers, credited the efforts of conference chairman, T. Y. Lin, and his hard-working committee for much of the success of the conference. Dr. Lin is professor of engineering at the University of California, Berkeley campus, and chairman of the ASCE Structural Division's Committee on Bridge Loadings.

General Arrangements Committee for World Conference on Prestressed Concrete consists of (seated in usual order) Ben C. Gerwick, Jr.; Robert H. Singer, treasurer; T. Y. Lin, chairman and conference coordinator; and Harold A. Price, secretary. Standing, left to right, are A. C. Scordelis, Kenneth L. Downes, Jr., Jack Streblow, and Prof. J. W. Kelly.

Materials and Techniques Studied

The conference gave first attention to the variety of techniques in use in various parts of the world and the versatility of materials used. This session was moderated by Leo H. Corning, vice-chairman of the Structural Division and chief consulting structural engineer for the Portland Cement Association. One of the papers presented at this session—on "Post-tensioning Systems and New Grouting Methods in Germany," by Prof. W. Zerna, of the Hanover Technical University—was indicative of the international character of the conference.

At a session on foreign developments in design and construction, recent prestressing work in Italy was described by Prof. Franco Levi; rigid building frames of prestressed concrete in active earthquake areas were discussed by Prof. Shizuo Ban of Japan; use of concentrated tendons for long-span prestressed concrete bridges by Dr. Fritz Leonhart of Germany; and prestressed concrete suspension bridges by Prof. D. C. C. Vandespitte of Belgium. Prestressed concrete airfield pavements, concrete piling and marine structures, prestressed concrete cylinder piles, and prestressed dams—all in Algeria—

were topics of still another session.

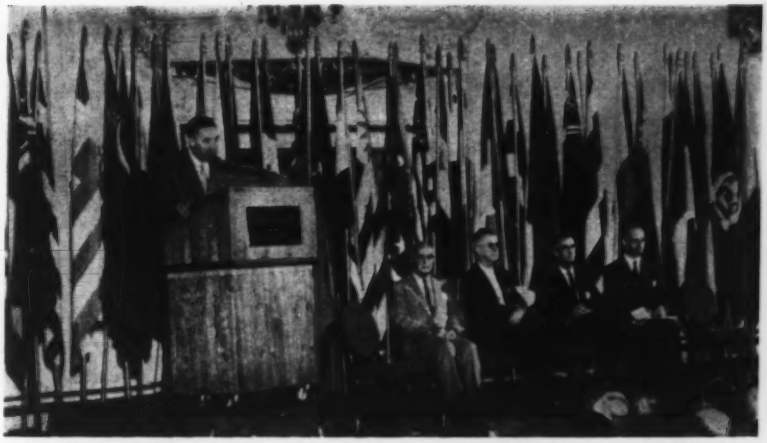
The final session included papers on the manufacture of prestressed concrete in various countries under the titles of pretensioning plants and production methods in the United States; sectional precast prestressed concrete beams (in England); and automation of prestressed units in the USSR.

The extent of the program makes it impractical to comment on individual papers. Those interested may obtain a copy of the complete conference proceedings from the World Conference on Prestressed Concrete, Inc., 417 Market Street, Room 216, San Francisco, Calif. There will be a charge of $10 per copy. Because only a limited number of copies are to be printed, orders should be placed at once.

Industry Anticipating Standards

Frequently during the conference reference was made to the need for the forthcoming ASCE-ACI "Recommended Practice for Prestressed Concrete," which is expected to be approved for publication soon. Lack of such standards was cited as a principal obstacle to the use of prestressed highway structures. The first and only guide to the design of structures acceptable for federal-aid projects is the Bureau of Public Roads' "Design Criteria for Prestressed Concrete Bridges," issued in 1952 and revised in 1955. Yet the use of this material has increased until, in a recent address, Federal Highway Administrator Bertram D. Tallamy stated, "We have plenty of evidence now that prestressed concrete in small structures and in long structures is competitive with structural steel, and in many cases we have received bids where the price was less than structural steel. As contractors become familiar with the use of it—and the skilled workers are now more familiar with the making of the forms and with the tensioning of the steel—they are learning that it is not something so theatrical as to be beyond their ability. I am sure that it is going to be highly competitive."

Another indication of the trend is the rapid growth of the trade organization, the Prestressed Concrete Institute. This group was organized in 1954 and now has an industry membership of 300. Meeting concurrently with the Prestressed Conference, the group elected Ben C. Gerwick, Jr., as president, and Harold A. Price as vice-president. Mr. Gerwick is president of the Petaluma organization bearing his name, and Mr. Price is manager of the Structural Concrete Products Division of the Basalt Rock Co., Napa. Peter J. Verna, Jr., president of Concrete Materials, Inc., Charlotte, N. C., was named secretary-treasurer of the institute.



Mayor George Christopher of San Francisco welcomes delegates to World Conference on Prestressed Concrete. With him on the speaker's platform are (in usual order) Prof. J. W. Kelly, William E. Dean, J. Ashton Gray, and Philip H. T. Gooding. Photo courtesy of Cristof Studio, San Francisco.

Cooperating societies, in addition to the ASCE, were the American Association of State Highway Officials, American Concrete Institute, American Institute of Architects, Associated General Contractors, Association of American Railroads, International Federation for Prestressing, National Science Foundation, Portland Cement Association, Prestressed Concrete Institute; and Structural Engineers Association of California.

Information for this account of the congress was supplied by J. W. Kelly, M. ASCE, professor of civil engineering at the University of California, and Don P. Reynolds, M. ASCE, Assistant to the Secretary of ASCE and headquarters representative at the congress.

Actions of ASCE Executive Committee Briefed

President Lockwood called the Executive Committee to order on August 9 at the Netherlands-Hilton Hotel in Cincinnati. The following actions were taken on matters needing attention before the Board of Direction meets in October.

Task Committee on Professional Education

A change in the name of the Task Committee on Engineering Education to the Task Committee on Professional Education was approved. This was done at the request of the Board, with the concurrence of the standing Committee on Engineering Education, and with the approval of the task committee itself. The Task Committee on Professional Education is scheduled to report the results of its survey of the profession at the October Convention.

Election Closure Date

In accordance with Bylaw provisions (Art. V, Sec. 3), the closing date for the election ballots was confirmed as of Friday, September 13, 1957, instead of Sunday, September 15.

Interim Appointments

ECPD. Clarence H. Ax was appointed to succeed Ralph E. Fadum as ASCE's representative to ECPD for a three-year term beginning October 24, 1957. The Committee recommended that Mr. Ax be named to the ECPD Executive Committee for the year 1957-1958.

J. Waldo Smith Fellowship Committee. John S. McNown was appointed to succeed George R. Schneider for a three-year term beginning in October 1957.

Committee on Junior Member Publications. James M. Morgan was appointed chairman, and the Committee on Junior Members was authorized to name the remaining personnel of Professor Morgan's Committee on Junior Member Publications.

Organization of Foreign Membership

ASCE has members in more than 100 foreign countries. The Executive Committee instructed the Executive Secretary to study data and recommend procedures and rules with respect to membership requirements, Local Sections,

and Student Chapters in countries outside the United States.

Television Series Entitled "Engineer"

The Committee approved wholehearted endorsement of EJC sponsorship of the proposed television series entitled "Engineer."

Proposed Change in Name of Bureau of Yards and Docks

The Executive Committee recommended to the Board of Direction that ASCE support legislation currently before Congress (HR 7256) to change the name of the U. S. Navy Bureau of Yards and Docks to the Bureau of Civil Engineering.

The Committee also recommended appointment of a task committee to make a one-year study of the responsibilities and assignments of members of the Board of Direction with a view toward reduction of the routine functions imposed upon them.

Spring Meeting in Phoenix

The Arizona Section's invitation to meet in Phoenix, Ariz., in conjunction with the meeting of the Pacific Southwest Council, April 17-19, 1958, was accepted.

ASCE QUARTERLY ENGINEERING SALARY INDEX

Consulting Firms

CITY	CURRENT	LAST QUARTER
Atlanta	1.10	1.10
Baltimore	1.09	1.02
Boston	1.09	1.07
Chicago	1.12	1.06
Denver	1.11	1.04
Houston	1.04	
Kansas City	1.08	1.06
Los Angeles	1.14	1.14
New Orleans	1.00	1.00
New York	1.15	1.11
Pittsburgh	1.05	1.05
Portland	1.08	1.06
San Francisco	1.15	1.09
Seattle	1.10	1.05

Highway Departments

REGION	CURRENT	LAST QUARTER
I, New England	0.84	*
II, Mid. Atlantic	1.10	
III, Mid. West	1.16	
IV, South	1.04	
V, West	0.96	
VI, Far West	1.06	

The ASCE Survey of Engineers' Salaries is reviewed in the July issue (page 79).

Figures are based on salaries in effect as of May 15, 1957. Base figure, the sum of Federal Civil Service, G.S. Grades 5, 7 and 9 for 1956, is $15,930.

* No figures are given for the last quarter in the Highway Department category because the scope of the index was widened and the figures for the two quarters are not truly comparable.

Department of Conditions of Practice Meets in Cincinnati

Problems of broad professional impact were given extensive consideration at a two-day meeting of the Department of Conditions of Practice on August 10 and 11. The meeting brought together the chairman, vice-chairman and the Board contact member of the ten standing committees of the Department. Committee activities of the past twelve months were reported, and the ground work was laid for an active program for the coming year.

The Committee on Employment Conditions reviewed its plans for a questionnaire to be circulated in 1958. It also made recommendations for Conditions of Practice programs to be presented at national conventions.

Engineering Education Discussed

The Committee on Engineering Education held a two-day meeting of its own prior to the Department meeting. Among the projects developed by the Committee are an organized plan to further opportunities for young engineers to continue studies either on an individual or group basis after graduation from college and while they are employed. The first draft of the new brochure for college freshmen was presented. It is aimed at orienting the student as he embarks on a career in civil engineering. The Committee also presented a resolution proposing the use of educational facilities and faculties on a twelve-month basis instead of the conventional nine months. The Committee feels that the current shortage of classroom space and faculties, both at college and high school level, demands a bold positive approach if it is to be solved. The Committee also reported an active program to increase liaison between itself, ECPD and ASEE. It was noted that significant progress has already been made.

The Committee on Junior Members reported on the progress it is making in organizing a subcommittee for the purpose of encouraging more Junior Member contributions on a regular basis to CIVIL ENGINEERING. Among its other activities during the course of the year was development of a program of direct contact with employers, enlisting their assistance in encouraging young engineers to participate in Local Section activities. A study of the American Medical Association program for professional indoctrination and orientation made by the Committee has been turned over to the newly formed Task Committee on Professional Attitudes.

The Committee on Local Sections reported four successful conferences held throughout the year—in Worcester, Mass., Walla Walla, Wash., San Jose, Calif., and Grand Rapids, Minn. The Committee also noted the formation of a new Local Section in Colombia, South America, and recommended the formation of two new Branches—the Northwestern Branch of the South Carolina Section and the Albany Branch of the Georgia Section for Board approval. It noted that its plans for 1958 included three Local Section Conferences to be in the Southeast, Middle Atlantic, and Pacific Northwest. Thirty-eight Local Sections and other Branches will be invited to participate in these programs.

The Department of Professional Practice discussed its review of Manual 29, in which studies of equitable fees to be paid for engineering services are being evaluated. In the revised manual the committee also expects to be able to include a standard contract form between client and engineer. Also in the works is the standard agreement between engineer and architect. In connection with this, the committee is currently studying the possibility of recommending fees to be paid by engineers and architects and vice-versa. While the wording of Article 7 of the Code of Ethics has been under consideration by the subcommittee, no report was presented at this time. The Committee recommended that further investigation be made into the subject of errors and omissions insurance.

Registration of Engineers

At the request of the Board of Direction, the Committee on Registration of Engineers has prepared a statement of policy regarding the licensing of engineering practice. The committee reaffirmed its endorsement of the Model Law and further recommended that ASCE exert all feasible efforts to cooperate with the NCSBEE toward the improvement of registration laws and their enforcement. It further stated that registration in categories of engineering practice should be held to the major branches, Civil, Mechanical Mining, Chemical and Electrical. In its opinion the most desirable procedure is registration as a professional engineer. The committee is continuing its study of procedures used by the various states in enforcing registration laws and encourages the Local Sections to participate in implementation of state registration laws.

The Committee on Salaries presented its report, noting that its biennial survey will be available to the membership in August and that the Engineering Salary Index has been developed and appears every month in CIVIL ENGINEERING. The Committee on Student Chapters reported on four Faculty Adviser Conferences held during the year. It approved the establishment of Student Chapters at UCLA and at South West Louisiana Institute for action by the Board of Direction. Approval was given to holding Faculty Adviser conferences in New York in October 1957 and Chicago in February 1958.

The Committee on Session Programs presented its plans for Conditions of Practice sessions for the next two years. The Committee noted that attendance at Conditions of Practice sessions is much larger when there is no conflict with the technical program and urged that this fact be given consideration in planning future Conventions. The Committee on Cooperation with Local Sections and Regional Councils presented its plans for stimulating Local Section participation in the program of the Department. It urged that Directors and Vice-Presidents meet with Local Section groups to inform them of various projects being undertaken by the Department and to enlist participation by the Local Sections.

Those in attendance agreed that the meeting of the Department served to integrate the activities of the various departments. The results in terms of projects initiated and studies advanced were significant. The impact of the work undertaken at Cincinnati will certainly be far-reaching as it affects the professional aspects of civil engineering practice.

EJC-ECPD Survey Of Profession Slated

Plans to conduct the most comprehensive survey of the engineering profession ever undertaken were given impetus with the recent appointment of a joint task group of Engineers Joint Council and Engineers' Council for Professional Development. The task committee will set up a program to be used in soliciting supporting funds required for conducting the survey. It is made up of distinguished engineers under the chairmanship of Dr. Joseph W. Barker, M. ASCE, president of EJC and chairman of the Board of the Research Corporation.

New York City Site Selected for New Engineering Center

The arrow marks the site acquired for the new 20-story Engineering Center. At left are the United Nations General Secretariat and Assembly Building (with the dome). The Carnegie Foundation building is immediately adjacent to the Society's new property, which is in the heart of an important educational and cultural development. East River is in immediate foreground.

Purchase by the United Engineering Trustees, Inc., of 37,500 sq ft of property on the west side of First Avenue between East 47th and 48th Streets at an approximate price of **$2,700,000** has been announced by W. J. Barrett, president of United Trustees.

The site includes the entire block front on the west side of First Avenue between East 47th and 48th Streets, and extends back from First Avenue for 150 ft on East 47th Street, and for 225 ft on East 48th Street. This section of First Avenue has been renamed the United Nations Plaza.

Title to the principal part of the property was recently taken by United Engineering Trustees, Inc. This includes property owned by the Carey Garage Corp. containing a garage with entrance on East 48th Street and a vacant lot at the corner of First Avenue and East 47th Street. Previously acquired from the 849 First Avenue Corp. was a parking lot facing the United Nations Plaza, and a five-story tenement building at 344 East 48th Street. The remaining parcel, completing the entire block frontage on First Avenue, is at the corner of East 48th Street and will be taken over by United Engineering Trustees, Inc. in a year as a result of a purchase contract with the Socony Mobil Oil Co., Inc. All negotiations were made through the Cross and Brown Co., of New York City.

United Engineering Trustees, Inc., which was established in 1904, is the corporation in which five national engineering societies will be associated in the development of the new property. In addition to ASCE, the participating societies are ASME, AIEE, AIME, and AIChE. Together the five societies have more than 175,000 members in all parts of the world.

The present 16-story headquarters building on 39th Street was built in 1906 by a gift of **$1,050,000** from the late Andrew Carnegie "to promote the solidarity of the engineering profession."

Engineers have now been named for the new 20-story Engineering Center. They are Seelye, Stevenson, Value & Knecht, the structural engineers; and Jaros, Baum & Bolles, the mechanical engineers. As previously announced, the architects for the new center building are the New York City firm of Shreve, Lamb & Harmon Associates. The architects' rendering of the new headquarters will be reproduced in an early issue.

The purchase of a site for the Engineering Center was hailed by the *New York Times* in a leading editorial on August 2. Said the *Times*, "This ratification of the decision to stay in New York is fine news. It strengthens and reaffirms our position as the headquarters city. The societies seem to have made an excellent choice of site. We are confident they will find they have made no mistake in remaining at the crossroads of the world. Their presence here is, of course, most advantageous to our business, industry, professions, and educational institutions."

Division Doings

Pipeline Division Organizes New Committee

The Pipeline Division has completed the organization of its Committee on Pipeline Crossings of Railroads and Highways. The new committee has 32 members and is headed by J. E. Thompson, of the Natural Gas Pipeline Company of America. Primary aims of the group are to gather and disseminate information on the design and specifications of pipeline crossings as required for railroads and highways, and to further the mutual use of recommended codes and design standards among pipeline, highway and railroad groups and public authorities.

Progress towards the completion of a tentative specification—to be submitted to the American Standards Association for adoption as a standard code for pipeline crossings under, and parallel to, railroads and highways—is proceeding with the formation of task groups within the committee. A number of organizations, including the ASCE Highway Division, will be given a chance to see the preliminary draft of this specification at their fall meetings.

Highway Division Appeals to Local Sections

At a recent meeting the Highway Division's Executive Committee urged the Local Sections of the Society to take greater interest in engineering affairs involved in the development of their states and local communities. Especially important, it was the consensus, is the role of the Sections in advancing the highway program. According to the committee, the Sections might to advantage "study and analyze proposed highway plans and locations, and support sound plans, particularly at public hearings."

In the location of new arteries, the committee points out, the unified support of planning commissions, park boards, city officials, civic groups, and individual property owners is an absolute must. With the 1956 Federal-aid Highway Act that set up the accelerated highway program requiring public hearings on all projects entering or bypassing communities, engineers at local level can do a great deal to push the highway program by turning out in force at such hearings.

Says the committee, "usually where controversy exists opponents turn out in force while the proponents do not." Such a situation in highway location, it emphasizes, is likely to mean delay in carrying out the program and even construction of unsatisfactory projects.

Arch-Dam Symposium Papers Available

The twenty Arch-Dam Symposium papers, sponsored by the Power Division at the Knoxville Convention last summer, have now been assembled in a single volume. During the past year the papers were printed in various Journals of the Power Division and in CIVIL ENGINEERING. The Department of Civil Engineering at Colorado State University is responsible for the valuable compilation, and copies may be ordered from the department at $5 apiece. For convenience in ordering there is a coupon on page 148.

In the Structural Division

In line with a new Structural Division policy of centering its meetings around themes, when it is practical to do so, the theme of the Structural Division meetings for the forthcoming Annual Convention in New York this October is "Forces on Structures." Four of the five scheduled Convention sessions are connected with each other as well as related to this overall theme. They are on Blast Forces, Earthquake Forces, Wind Forces, and Forces on Aircraft Frames. The fifth session—devoted to highway structures—includes four papers on special structural problems incident to highway projects in the Metropolitan New York area. This will be a joint session with the Highway Division.

In the program on Forces on Aircraft Frames, an attempt will be made to take advantage of the findings of former civil engineers now in the aeronautical field. The aeronautical industry has had to solve many problems that were previously considered economically unjustifiable in regular structural engineering design. This program will also discuss the present status of the use of computers in solving structural engineering problems. The findings of the Division's Committee on Wind Forces will be reported in the Wind Forces session. The program on Blast Forces will be a report on the status of work being done in protective construction with particular emphasis on new developments. The Earthquake Forces program is also timely, emphasizing as it does the recent West Coast earthquakes.

The Division stresses the "extreme importance" of its Convention theme. It notes that, "More accurate determination of loads on structures will result in more efficient design with resultant savings. Modern efficiencies and savings resulting from elaborate methods of design and analysis, including present trends to more use of electronic computers, can be no better than basic assumptions and determinations as to superimposed loads."

Total Membership as of August 9, 1957

Members	9,671
Associate Members	13,119
Junior Members	17,466
Affiliates	73
Honorary Members	46
Total	40,375
(Aug. 9, 1956	39,473)

The Good Old Days

Forty years ago when the Society had only a few more than 8,000 members, a special committee on compensation made a complete investigation of the compensation of civil engineers. (TRANSACTIONS, 1917, Paper No. 1379.)

Circulars were sent out by the committee, headed by Nelson P. Lewis, to both members and non-members. Of the 6,378 usable returns received 5,059 were from members of the Society. This was a remarkable return percentage-wise.

Starting salaries forty years ago ranged from a low of $600 to a high of $2,500 per year, averaging $1,200 per year. The extent of experience recorded ranged up to 50 years. For the 5,042 members the average annual compensation was $4,141; for the 1,316 non-members $3,389; for 4,529 graduates of engineering schools, $3,982; and for 1,829 non-graduates, $3,993.

On the basis of nature of service of civil engineers forty years ago, the average annual compensation was found to range from a low of $2,735 for those employed by states and counties; through $3,335 by railroads and $6,737 by consulting engineers; to $7,678 by contractors.

Some present members will remember that several conditions of employment were different from what they are today. For example, the work week was nearer 50 to 60 hours than today's 35-hour week; there were no income tax payments to be made, or other deductions from the monthly paycheck; and dollars were worth 100 cents.

Getting More Students into Engineering

M. J. Shelton, M. ASCE

Vice Chairman, ASCE Committee on Engineering Education; Deputy Director, California State Division of Water Resources, Sacramento, Calif.

Industry must cope with the present shortage of engineers as best it can by makeshift methods, but the long-range solution involves the creation of greater student interest and the education of more students as engineers. This was the conclusion early reached by the Student Activities Committee of the San Diego Section of ASCE. My comments here are based on the experience of this alert committee, and on my observations as president and secretary of the Section and Director for the District.

A review of published findings indicated that the shortage of engineers was due to a scarcity of science and mathematics teachers in the secondary schools. Solutions commonly suggested were to make these teaching roles more attractive by increased pay, by opportunities for related summer employment, and by volunteer assistance in class instruction. These suggestions were found to have much merit but could not be accepted as the complete answer.

The San Diego Engineering Council, consisting of delegates from the Founder Societies in the area, was formed in 1947 with ASCE as the prime mover. It represents about 900 engineers in the area. For the past six years it has furnished engineering speakers to the various high schools in San Diego County on "career days" and during "engineers' week," and has worked with the schools on the annual "science fairs."

To arrange the Engineers' Week programs, members of the Student Activities Committee in February visit every junior and senior high school in the country to leave: (1) a list of available speakers and topics; (2) a list of plants and facilities available for organized tours; (3) magazines and journals collected by Committee members; (4) invitations for about 150 teachers and counselors to the kick-off dinner; and (5) an invitation to the dinner for one science or math student from each school.

Since many elementary school teachers have not had courses in general science, we believed that a specially designed science course for teachers' colleges or teacher refresher courses would be helpful. San Diego had such a course in the 1956-1957 school year.

The Committee found it most helpful to develop a "resource file" of local citizens qualified to lecture to elementary school pupils—a sort of speakers' bureau. Development of various science teaching aids has also been suggested, such as comic-books and the Walt Disney type of movie. Virtually all California elementary schools have audio-visual facilities and could well use such films.

It may be asked why I am talking about elementary schools when this problem is generally considered in terms of counseling at the high school level. The answer is that the Committee has found it necessary to attack the problem long before the student arrives in high school. The first effort should be directed at fourth- or fifth-grade students and the second at those in the eighth and ninth grades, who are readily interested and often show great ability. The latter effort has been exerted particularly through the science fairs, which have recently taken on national scope. Locally these started in the high schools, but one of them about three years ago sponsored a fair for the junior high schools which drew 30 exhibits. The following year interest mushroomed.

Aptitude tests and counseling should be applied more extensively at the elementary-school level, and test results should accompany students' transfer records to high school. Special emphasis should be placed on training of teacher counselors, utilizing lectures by representatives of the engineering and scientific fields.

Enriched or accelerated programs for gifted children hold much promise. The San Diego city schools have developed a well-coordinated program for gifted children as well as a program of honors courses which enables capable seniors to receive advance credit on entering certain colleges and universities. These efforts tie in with the Committee finding that more individual attention per student is desirable, and with the need for more classroom space to avoid double and triple sessions—a truly national problem.

If students are properly conditioned in the elementary school and properly trained in the basic sciences in high school, enlightened counseling at high school level is probably the most important factor in obtaining students for college courses in science and engineering. Locally the profession has been participating in high school "career days," devoted to discussions of opportunities and responsibilities in engineering—and we offer it as the basic program in any area.

To study the factors influencing the career decisions of high school students, the Committee, with the active cooperation of the Office of the San Diego County Superintendent of Schools, prepared a questionnaire and submitted it to some ten thousand high school students. Replies are now being analyzed by the Committee. About 75 questions were asked. From the standpoint of the school administrators, the questionnaire was designed to determine the effectiveness of their counseling programs. The Committee's objective is to determine why a greater percentage of students are not interested in further study in science and engineering.

The engineer shortage cannot be attributed to educational deficiencies at any particular age level but is the result of educational weaknesses virtually throughout the entire life of the individual. Engineering education begins in the elementary grades and continues throughout high school and college. Finally, the young graduate needs on-the-job training and self-improvement programs. Members of the profession can help by offering their services to acquaint students and teachers alike with opportunities in their respective fields.

(This article is taken from Mr. Shelton's paper presented at the ASCE Jackson Convention, in the panel sponsored by the Committee on Engineering Education, at the Department of Conditions of Practice session presided over by Department Chairman Glenn W. Holcomb, with Elmer K. Timby as moderator.)

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1958 contest closes May 1, 1958. See 1956 Official Register, page 132; July 1957 issue of CIVIL ENGINEERING, page 72.*
FREEMAN FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 142.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 143.*

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

The **Cincinnati Section** and the **District 9 Council** were hosts to the annual meeting of the Department of Conditions of Practice on August 10 and 11. Slated to preside over the Council for the coming year are Floyd F. Schrader, of the Kentucky Section, as chairman; John W. Hubler, of the Akron Section, as vice-chairman; and Charles B. Smith, of the Central Ohio Section, as secretary-treasurer. The Council will hold its spring meeting in Akron on April 18 and 19 as guest of the **Akron Section.** A Local Sections conference is tentatively scheduled in conjunction with the meeting.

To give its construction engineers a common meeting ground for the exchange of information, as well as to round out its Technical Group set-up, the **Los Angeles Section** launched a Construction Group in September 1956, now completing a highly successful first year. All members who are interested in construction now have the opportunity to become acquainted with their colleagues and exchange ideas. Meetings are usually held on the third or fourth Thursday of January, March, May, September, and November. They are informal gatherings highlighted by life stories and anecdotes, candid speeches, panel discussions and lively question-and-answer sessions. With construction becoming more of a science each year, the group's aim is to help the men involved to obtain the status they deserve. The enterprising group is headed by Richard C. Gerke. Our thanks to Sam Keller, chairman of the Publications Committee, who supplied the above information.

Alvin M. Fromherz, prominent New Orleans engineer and member of the **Louisiana Section,** was made first honorary member of the Tulane University Student Chapter at a joint meeting of the Chapter and the Section held at the close of the current academic year. Mr. Fromherz was presented a citation in recognition of his "untiring devotion to the improvement of the civil engineering profession." In the featured talk, Mr. Fromherz emphasized the necessity of obtaining and maintaining professional recognition.

The **Junior Member Forum** of the **Metropolitan Section** recently enjoyed an enlightening field trip to the Brooklyn Navy Yard. Projects visited included the graving dock and ships in construction. New Forum officers for the coming year are Milton Alpern, president; Harry Rode, first vice-president; Joseph De Salvo, second vice-president; Frank Brennan, secretary; and Howard Grill, treasurer.

Congratulations to the **Mid-South Section** on a valuable new project. The Section has established a Vocational Guidance Committee to help combat the nationwide shortage of engineers by furthering guidance programs at the local level. The goal of the committee is not to "sell" civil engineering, but rather to present prospective civil engineers with information about the profession. After a barbecue, members and guests of the **Jackson Branch** heard a timely discussion on highway safety, presented by the Mississippi Highway Patrol. Brig. Gen. Lyle E. Seeman, division engineer for the Southwestern Division of the Corps of Engineers, reviewed the recent flood experiences of the five states under his jurisdiction at a recent meeting of the **Vicksburg Branch.** General Seeman emphasized the fact that flood damage estimated at $110 million in the Basins of the Brazos, Trinity, Red, Arkansas, and White Rivers would have been $252 million without any improvements. With all authorized projects completed, there would have been only $62 million damage.

Chris Medbery, San Francisco Section president, and other Society luminaries meet in San Jose to review program of Pacific Southwest Council for the year. In usual order are Mr. Medbery and Clarence Whalin (seated), and Members Obermuller and Whitman (standing).

New officers of the **Nebraska Section** for the coming year are Jesse B. Budd, Jr., president; Kenneth O. Kauffman, vice-president; and Gayle E. Achterberg, secretary-treasurer.

The high point of a recent meeting of the **Northwestern Section** was the presentation of annual student awards. Winners were Earl S. Mason, University of North Dakota; A. Russell Hanson, North Dakota State College; and Paul Seaberg, Myron Temmers, and Leonard Belk, all of the University of Minnesota. Section President J. E. Fant briefly discussed the fields the graduating civil engineers propose to enter. Speaker of the evening was President Mason Lockwood, who gave an illuminating talk on the budget and administrative problems of the Society.

The **Philadelphia Section** joins the growing group of Sections that are forming technical study groups. New in the Section is a Division of Hydraulics and Sanitary Engineering. Temporary officers of the new group are Walter A. Lyon, chairman; Romeo Falciani, vice-chairman; and William T. Savage, secretary. It is the hope of the Section that the Division will serve as a focus of professional interest for hydraulic and sanitary engineers in the Delaware Valley area. The Division plans to meet on the third Thursday of September, November, January, March and May.

The **Sacramento Section** is currently celebrating its seventeen hundredth luncheon meeting. Featured speaker on the noteworthy occasion was Allen H. Brownfield, supervising structural engineer, Division of Architecture, State Department of Public Works, who discussed "growing pains in the state's prestressed concrete building construction." During the summer the **Marysville Branch** joined the Section for a field trip to the Berkeley Laboratory and to the construction site of the new Carquinez Bridge. Arrangements for the enjoyable visits were handled by George Smith of the Sacramento Section. A recent

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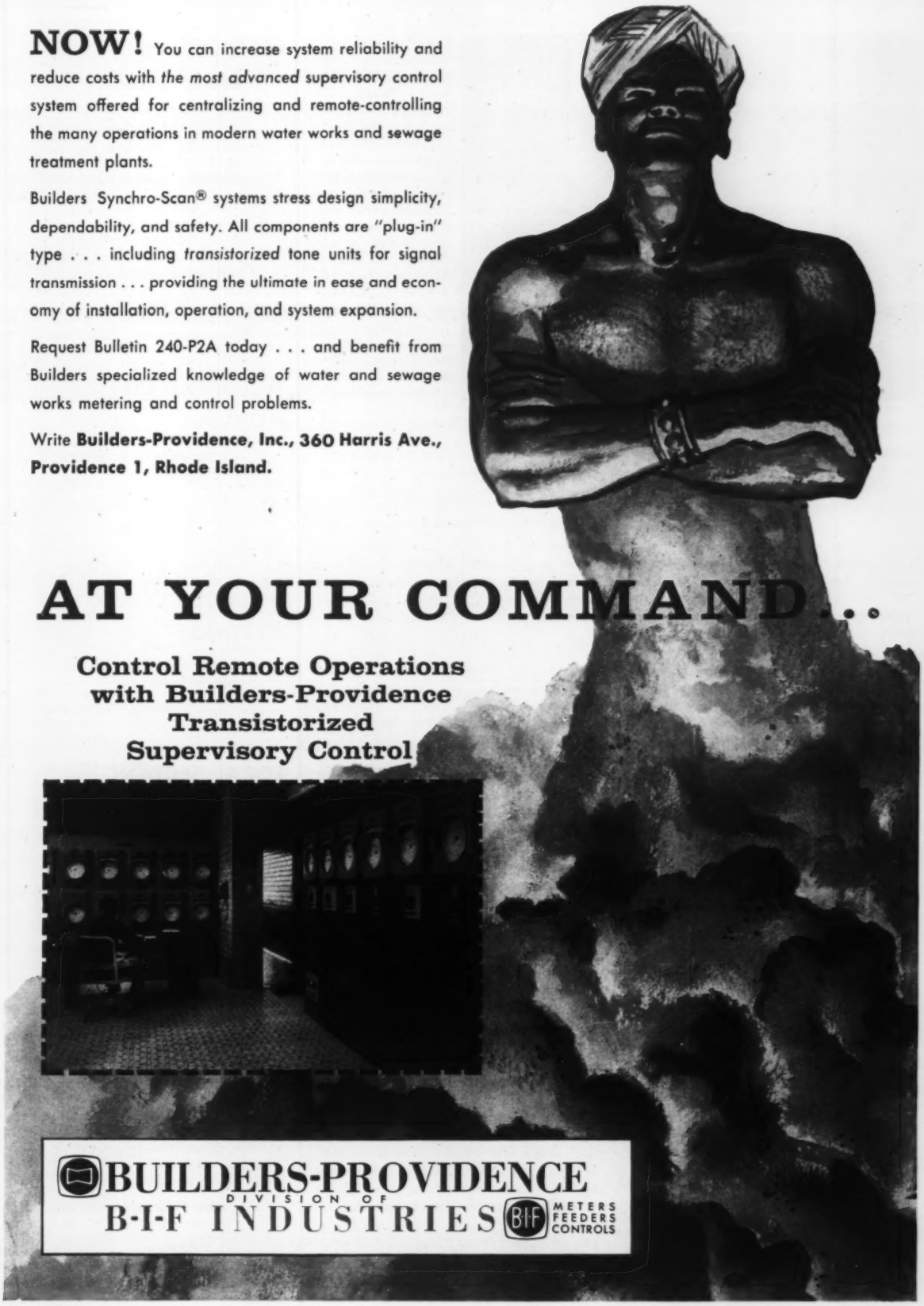

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The Panama Section has as its guest ASCE President Mason G. Lockwood, in Panama for the Seventh Pan-American Highway Congress. Shown from left to right are Manuel Font, executive secretary of the Engineering College of Puerto Rico; Col. Hugh M. Arnold, Lt. Governor of the Panama Canal Zone; President Lockwood; and Celso A. Carbonell, Panama Section president.

meeting of the Marysville Branch featured a film entitled "Water Builds a Foothill Empire." The film depicted the history of the Nevada Irrigation District, and was presented by the District.

Members of the **San Diego Section** recently heard an illustrated talk on "the federal interstate highway—plans and progress" given by John McNerney, district engineer for the Portland Cement Association. Mr. McNerney's discussion of the effects of the highway on California, sparked a lively question-and-answer period. New officers of the Section are Charles A. Smith, Jr., president; Bert C. Wilkas, first vice-president; Edward F. Gabrielson, second vice-president; Richard C. Clark, secretary; and Raymond F. Hall, Jr., treasurer.

An interesting and thought-provoking talk highlighted the **San Francisco Section's** recent dinner meeting. Edward V. Laitone, professor of mechanical engineering at the University of California, spoke on the development problems of guided missiles and supersonic flight.

Newly elected officers of the **Syracuse Section** are James E. Clyde, president; Lewis A. Dickerson, first vice-president; Walter K. Neubauer, second vice-president; Francis T. Sendker, secretary-treasurer; and Harold S. Fox, director.

Fun and food were on the agenda at the annual family picnic held by the **Holston Branch** of the **Tennessee Valley Section** this summer. Eldon F. Matteson, assistant project manager for Daniels Construction Company, described construction on the expansion of the Reynolds Aluminum Company's Lister Hill plant at a recent **Muscle Shoals Branch** meeting. Mr. Matteson's illustrated talk was both interesting and instructive. The **Knoxville Branch** heard a concise and informed discussion of the Knox County Metropolitan Planning Commission. Featured speaker was J. T. Harper. Most of the talk dealt with the pressing problem of tying the city's downtown street system to the encircling superhighway system. An animated discussion followed.

An intensive campaign is being conducted by the Membership Committee of the **Texas Section** under the leadership of Al Bahn. Its goals are to increase ASCE membership and to encourage current members to advance to the highest grade for which they are qualified. More than 3,000 letters accompanied by application forms have been mailed to non-member engineers. Slated to preside over the **San Jacinto Branch** for the coming year are Oliver L. Clevenger, president; Hugh Lansford, vice-president; Wallace F. Tate, secretary-treasurer; and Harry F. Hartman, Texas Section Director.

Prof. H. J. Kist, Netherlands bridge adviser (center), is guest of the Virginia Section on tour of the Hampton Roads Bridge-Tunnel Project. With him are Oscar Mulford, resident engineer on tunnel and bridges (left), and James A. Rives, past-president of the Section.

ASCE CONVENTIONS

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 14-18

CHICAGO CONVENTION

Chicago, Ill.
Sherman Hotel
February 24-28, 1958

PORTLAND CONVENTION

Portland, Ore.
Multnomah Hotel
June 23-27, 1958

TECHNICAL DIVISION MEETINGS

WATERWAYS & HARBORS CONFERENCE

Princeton, N. J.
October 18
(Part of Annual Convention program)

DISTRICT COUNCIL MEETINGS

DISTRICT 3 COUNCIL CONFERENCE

Syracuse, N. Y.
November 23

LOCAL SECTION MEETINGS

Kansas City—The Section will be host to ten other Sections in the area for a Highway Conference at the Hotel Continental, Kansas City, Nov. 7 and 8.

Metropolitan—First meeting of the season in the Engineering Societies Building, New York City, September 18, at 7:00 p.m. Ralph A. Fuller, division engineer for E. I. Du Pont de Nemours & Co., will speak.

Mid-South—Annual meeting at the Hotel Marion, Little Rock, Ark., October 10-12.

Philadelphia— Dinner meetings at the Engineers Club on the second Tuesday of each month. Meetings of the Division of Hydraulics and Sanitary Engineering at the Engineers Club on the third Thursday of September, November, January, March and May.

Tennessee Valley—Annual meeting at Knoxville on November 15 and 16.

Texas—Tri-Section meeting with Mexico and New Mexico Sections at the Hotel Cortez, El Paso, Tex., September 26-28.

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BY-LINE WASHINGTON . . . . .

A Congressional committee last month counseled a "go slow" course for a proposed $15.6-billion shelter construction program. The possibility of the federal government's launching such a huge program seems remote here just now, mainly because civil defense authorities themselves are still debating whether people should be "sheltered" or "evacuated" in the event of a threatened attack. The majority of members on the House Government Operations Subcommittee agreed that a quick start on a shelter-construction program seems necessary, then hedged at the high cost and the uncertainty of defense planning. Top-level planners pointed out also that such a gigantic public works program would place a tremendous drain on current supplies of steel and cement.

* * *

The bewitched and bewildered course of the federal government's lease-purchase program for post office and office space took another sharp turn last month in the House Public Works Committee. The committee refused to go along with a refined version passed a few weeks earlier by the Senate. In fact, it submitted an entirely different program which, if passed by the full House, will create quite a dilemma for the conference committee appointed to choose between the two—or reconcile them. The House committee now believes that the needed federal buildings should be financed by direct appropriation rather than by the lease-purchase arrangement.

Congressman Jones of Alabama told the House, in arguing for this device, that a "vicious campaign" is under way to convince Congress, contractors, and labor unions that public building construction will be stymied if the lease-purchase idea is jettisoned. The "direct appropriation" measure, he insisted, would actually cost $750 million less than the lease-purchase arrangement.

Meanwhile, for lack of a Congressional extension, the program has died.

* * *

Another reappraisal of the role of the federal government in public works planning and construction has been scheduled by a Congressional committee for next fall. The Joint Economic Committee of Congress has announced that it plans to scrutinize federal-spending policies in such fields as highway construction, urban redevelopment, and natural resources development. One intention is to discover the impact of these and other federal-aid programs on U.S. growth and economic stability.

A municipal representative told another committee last month that federal intervention is definitely needed in the public works fields and that programs for highway, urban renewal, pollution control, and airport construction would deteriorate if returned to the states. Speaking for the American Municipal Association, Patrick Healy declared that the highway program "would probably be seriously jeopardized"—and the urban renewal program "would come to a complete halt."

Municipal officials want direct assistance from Uncle Sam, he said; they do not want a chain of command, with the state in between. The practical reason is that many states are still dictated by rural interests. Big city officials have turned increasingly to Washington in recent years for the assistance that state legislatures have denied them.

* * *

Treasury officials will drag their feet in budgeting the record funds authorized by Congress a few weeks ago for urban renewal. The federal legislators, after considerable debate, approved a grant of $350 million for this type of construction next year. The administration had recommended only $173 million, and preliminary planning for the next budget indicates that it still may spend no more, in spite of Congressional wishes.

Municipal people are angry at this attitude. Federal aid for urban renewal is their only hope in the slow, uphill fight to bring life back to slum-ridden cities, they claim. Senator Joseph Clark of Pennsylvania, former mayor of Philadelphia, called repeated attempts to cut back the urban renewal program "incredible shortsightedness" and declared that slum clearance will come to a halt in many cities if federal aid is withdrawn.

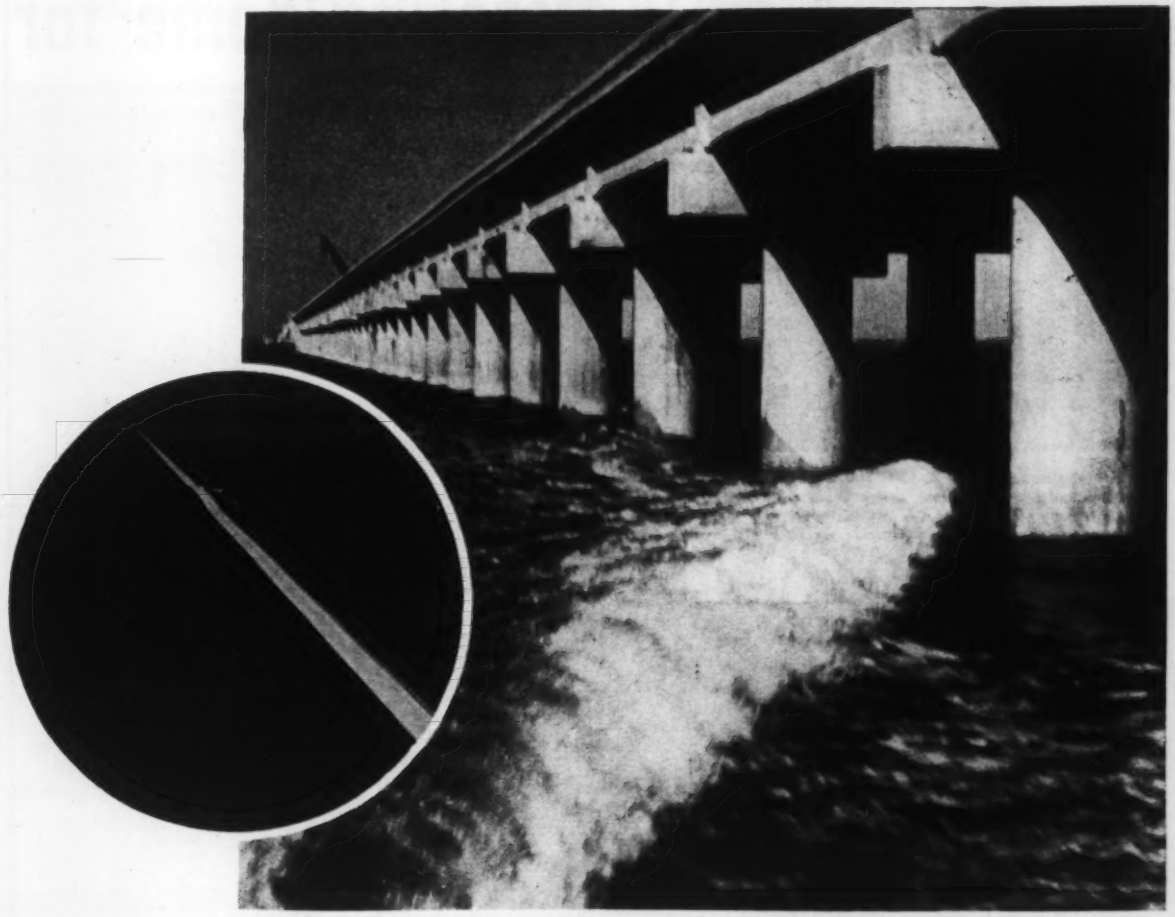
* * *

Both House and Senate have passed identical bills finally approving development of Niagara power by New York State. The $600-million project has been in a Congressional hassle for seven years, the source of harsh disagreement between public and private power advocates. The President signed the measure on August 22.

The mammoth power project will generate 1.8 million kilowatts—about one-fifth of the state's present capacity. The measure reserves half of the output for public bodies, half for private distribution. President Eisenhower has given his blessing to this arrangement, and the New York State Power Authority is itching to roll. It plans to finance the project by sale of revenue bonds.

* * *

The Department of Commerce is surveying nearly a thousand contractors this month to determine how much the cement strike hurt construction volume. Federal agencies involved in construction are agreed that the substantial wage increases won by cement workers will undoubtedly produce a boost in cement prices. . . . *Engineers for John McShain, Inc.,* have started work on a $35.4-million contract to construct a new State Department headquarters which will cover four square blocks near the White House. . . . *Two national construction organizations are producing* sound color motion pictures aimed at encouraging young men to enter the engineering profession. The American Road Builders Association and the Associated General Contractors of America have announced they will have films available this fall or winter for engineering groups to use in recruitment.



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Through the mass production of precast, prestressed concrete bridge units prefabricated on shore, the 24-mile Lake Pontchartrain Causeway was completed in one-fourth the time and at a much lower cost than ordinary bridge construction techniques would have required! Even the tough 19-month schedule which was set up was beaten by four months!

Ideal's plants at Baton Rouge, Mobile, and Houston, and cement terminal at New Orleans just across Lake Pontchartrain from the construction site assured a uniform flow of cement to keep the project going regardless of the severe cement shortage.

High praise is due the contractor—Louisiana Bridge Company, a joint venture of Brown & Root, Inc. of Houston, and T. L. James & Company, Inc. of Ruston, Louisiana—and Palmer and Baker, Inc. of Mobile, consulting engineers.

The Lake Pontchartrain Causeway and its use of precast, prestressed concrete demonstrates a practical solution to all similar bridge construction problems where beauty, completion schedules, freedom from maintenance, economy, and the ready availability of materials are important.

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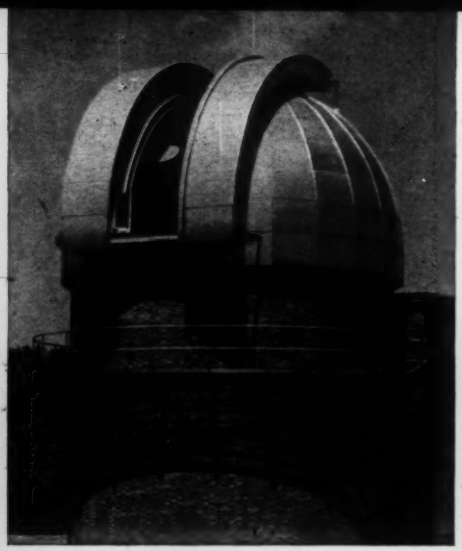
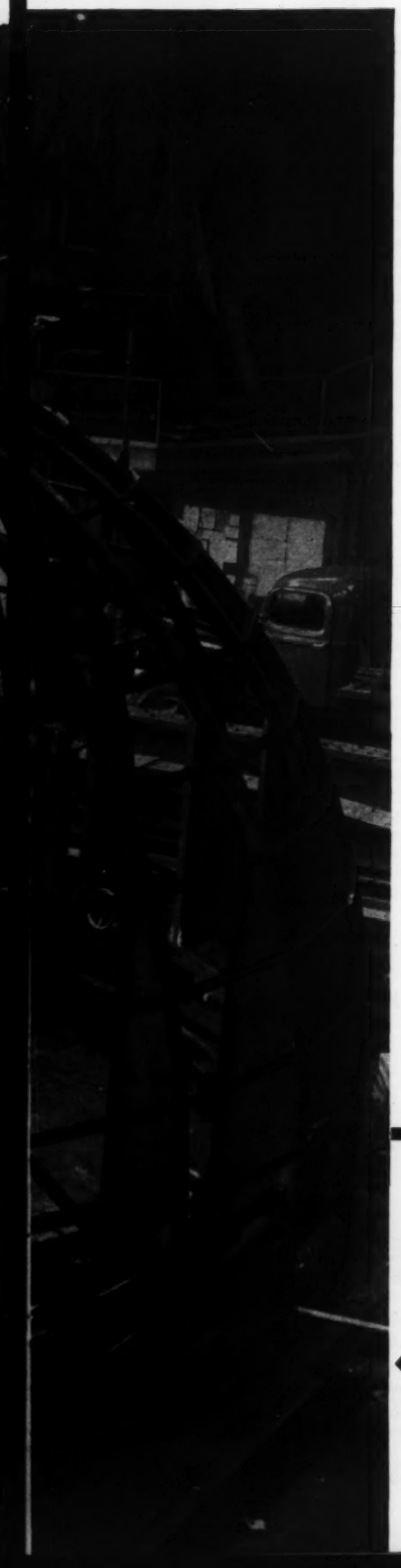


The Nassau Astronomical Station. The viewing opening is comprised of two shutters, which slide to the right and left. Fully open, the port is 7½ feet wide. A 1 h.p. motor opens and closes the shutters.

Case Institute Observatory

fabricated from USS STRUCTURAL STEEL



ON A 160-ACRE SITE, 1,250 feet above sea level in Northern Ohio, is the Nassau Astronomical Station, established by Case Institute of Technology to analyze the structure of the stellar system.

The observatory building houses a darkroom, a workshop, and living quarters for two observers. Topping the structure is a rotating dome, containing the 24—36-inch Schmidt-type telescope, one of the largest instruments of its type in the world.

The Structural Steel dome was prefabricated to specifications at the Cleveland, Ohio, plant of The Paterson-Leitch Company, then shipped to the observatory site. Although approximately 17 feet high and 28 feet in diameter, the dome is so well-balanced that a mere 5 h.p. motor is all that is needed to rotate it. The dome revolves about a circular track on steel wheels mounted on the underside of its base ring.

The dome being erected at the observatory.

Here is another application which points up the precision with which Structural Steel can be used, the ease with which it can be fabricated, and the almost limitless number of ways it can be shaped and formed. Structural Steel is one of the strongest of load-bearing construction materials—yet, paradoxically, it is the most economical. It possesses excellent mechanical properties, effectively resisting tension, torsion, compression and shear. Enclosed in buildings, it lasts indefinitely—requiring no maintenance. It may be riveted, bolted or welded – erected in any weather. And Structural Steel members can be fabricated indoors, where weather will have no effect on the quality of workmanship. We suggest that you fill out and return the attached coupon.

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The Structural Steel dome, prefabricated and assembled in the plant of The Paterson-Leitch Company, Cleveland, O.

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NEWS BRIEFS . . .

Earthquake Damages Mexico City Buildings

The earthquake in Mexico City on July 28 was the most severe in fifty years. Many buildings were damaged, some collapsed, a few escaped all damage. How these buildings behaved and why will be subjects for many engineering investigations and reports.

Mexico City is built on an ancient lake bed composed largely of volcanic ash and clay to a depth of about 105 ft—a spongy, highly compressible material having a very high water content. At this depth is a layer of cemented sand and gravel, in some places as much as 25 ft thick. Pumping has lowered the ground water level with resultant consolidation of the soil and settlement of the whole city at a rate of about 1 ft per year. Under the concentrated loads of buildings not supported on piles, the settlement has been more rapid.

The fifty-year-old Palace of Fine Arts (June 1955 issue, page 50), constructed on a massive concrete mat, has settled 10 ft below the city streets. Yet this building and ancient churches built on similar floating foundations seemed to come through the earthquake unscathed.

Many buildings are supported on piles driven to point bearing on the 105-ft strata of cemented sand and gravel. Among these is the newest and tallest building in Mexico City—the 43-story Latino-Americana tower, completed this year. It is supported on 360 button-bottom concrete piles driven by Western Foundation Co. to the top of the cemented strata. This skyscraper came through the earthquake with no damage of any consequence—not even broken glass. It was carefully designed to resist the maximum probable earthquake in Mexico City. (ASCE Proceedings Paper 917, March 1956.)

Buildings supported on piles driven to positive end bearing on the cemented strata settle only 6 in. per year, while the streets settle 12 in. per year. As a consequence, these buildings seem to grow. The earth shock, however, accelerated the street settlement, and this phenomenon accounted for many of the ruptured water and sewer lines from buildings to streets.

Some of the pile-supported heavy buildings are provided with built-in screwjack equipment at each pile, with which they can be jacked down to compensate for the faster settlement of the streets. These structures also suffered damage during the earthquake, due often to the displacement of the jacking equipment.

Many older buildings supported on wood piles driven to refusal fared badly. Wood piles customarily were driven in several 30-ft lengths—joined together with a simple dowel or in some cases a metal collar. There was neither certainty that piles driven in this manner did not buckle, nor that they reached point bearing on solid strata.

Unequal settlement under buildings left some tilted out of plumb as much as a foot. After adjacent buildings had been slammed against each other and damaged, wide joints were left between them.

Engineers in Mexico seem to agree that the provisions of the Federal District Building Code are inadequate, that the code must be amended for immediate guidance of designers and builders, and that the code ultimately should be completely overhauled.

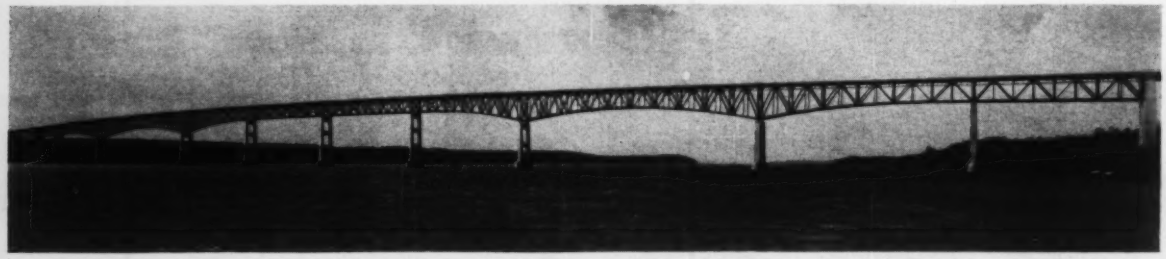
In a subsequent issue of CIVIL ENGINEERING, detailed results of the government's investigation of the July 28 behavior of buildings are scheduled for publication under the by-line of J. H. Thornley, M. ASCE. His recent personal investigation of the earthquake damage is the basis for these observations.

Center for Cleveland Engineering Societies

Cornerstone-laying ceremonies for the new $1,525,000 Cleveland Engineering and Scientific Center, slated for completion next summer, took place at a large Civic Luncheon on August 13. Charles F. Kettering, Honorary Member of ASCE, famous inventor and executive of General Motors, was guest of honor and featured speaker at the ceremonies.

The ultramodern building, with exterior of metal curtain-wall panels, glass, and grey brick, will provide 55,000 sq ft of space for meetings and other activities of the Cleveland Engineering Society and the other 51 member groups of the Cleveland Technical Societies Council. It will also house the 26 staff employees of the Cleveland Engineering Society, who work under the supervision of Executive Director Donald H. Cornish.

New Kingston Bridge Speeds Traffic Over Hudson



The $20,000,000 Kingston-Rhinecliff Bridge, which was dedicated in May, carried 65,146 vehicles across the Hudson in June. It is expected that this bridge traffic will be doubled when the New York State Department of Public Works completes a west bank extension to Route 9W now under construction. The east bank approach currently has connections with Route 9G and with the Taconic Parkway via Routes 308 and 199. The new Hudson River crossing features two continuous deck-truss units of 500-, 800-, and 500-ft spans, with one of these units centered over each navigation channel. It was designed by D. B. Steinman, M. ASCE, consultant on the project for the New York State Bridge Authority.

Designer Selected for New York Bridge Projects

The Port of New York Authority announces that O. H. Ammann, veteran bridge designer and Honorary Member of ASCE, will be design consultant on the second deck of the George Washington Bridge. The recently authorized $182,000,000 bridge project will include a six-lane lower deck and required approach highways in New York and New Jersey. Preliminary test borings will be made on the Manhattan side this fall, with the start of construction set for next summer. It is expected that the lower deck will be ready for traffic in 1962.

Mr. Ammann, senior partner in the New York City engineering firm of Ammann & Whitney, was the original designer of the bridge and chief engineer of the Port of New York Authority during construction of the project over a quarter of a century ago. Mr. Ammann has also been retained to design the Narrows Bridge, which the Port Authority will build between Brooklyn and Staten Island.

TV Series to Tell Story Of Construction Industry

The vital story of the nation's largest industry—construction—will be told on television for the first time this fall. Announcement of the program, which will be called "Building America," has been made by the Producers' Council, the sponsoring organization. The program, a filmed documentary series, will be shown by over 200 television stations with an estimated weekly audience of 7,500,000. It will be distributed through the Public Service Network, Princeton, N. J.

In addition to making the public better aware of how the $50 billion construction industry is serving it, the series will also be geared to the interests of architects, builders, distributors, and other segments of the industry.

Pan-American Highway Congress in Panama

A resolution approving detailed engineering studies of proposed highway routes through jungle country in Panama and Colombia was one of the important decisions coming out of the Seventh Pan-American Congress held in Panama City early in August. This decision, which had been reached earlier by a task committee, was formally adopted along with numerous other resolutions during the ten-day international meeting.

Ways of financing the detailed survey, which will require about $1,400,000, were also discussed. The areas to be surveyed are the Darien Province of Panama and the Choco region of Colombia. The route through Darien has been more or less determined, but more studies are needed before even a rough route can be fixed in Colombia. The 500-mile stretch in Colombia is the only section of the Pan-American Highway where construction has not been started. The permanent executive committee of the congress is studying a financing formula proposed to the congress by the Mexican delegate. The formula suggests that the United States pay two-thirds of the cost of the survey, Panama and Colombia two-ninths, and the other republics of the hemisphere one-ninth.

The attendance of 180 included delegates from all the Western Hemisphere republics. Nine nations were elected to the permanent congress committee. They are Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, the United States, and Venezuela. The next congress will be held in Bogota, Colombia, in 1960.

Among ASCE members attending the congress were President Mason Lockwood and Robert B. Brooks, St. Louis consultant and former Vice-President.

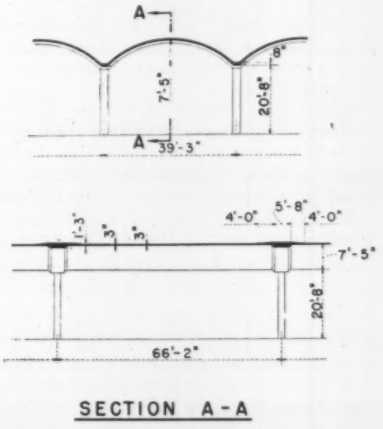
Cast-in-Place Concrete Shell Structure Bid Below Price of Precast Structure

Bids were opened recently for warehouses of thin-shell reinforced concrete construction—with column spacing 66 by 39 ft and total area of 640,000 sq ft—to be built at the Olmsted Air Force Base, Middletown, Pa. Alternate designs, utilizing both standard cast-in-place shell design and precast thin-shell elements supported on precast beams and columns, had been prepared by the Roberts and Schaefer Company for the Baltimore District of the Corps of Engineers.

Ritter Brothers of Harrisburg, Pa., was low bidder among six general contractors, and has been awarded the contract on the basis of the cast-in-place alternate. The cost of the cast-in-place structure was about 10 percent below that of the precast alternate. Possibly this indicates that movable forms and a plant for a mass-produced cast-in-place installation of this magnitude, is more economical than precasting, storing, transporting, and erecting precast elements on such a large area. The total cost of the structure, exclusive of an extensive site-development program, will be about $5.80 per sq ft. Construction was started early in August and is scheduled for completion in 1959.

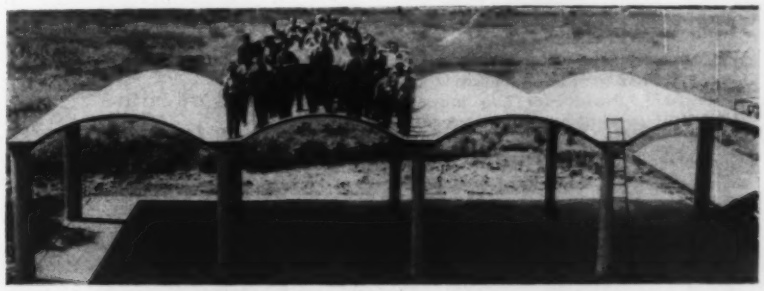
The design used is of a modified ribless shell type developed by the Roberts and Schaefer Company (see Fig. 1). The new structures will provide facilities similar to the standard AMC Warehouse of the Army Corps of Engineers.

Material for this item was supplied by Anton Tedesko, M. ASCE, of the Roberts and Schaefer Company, New York City.



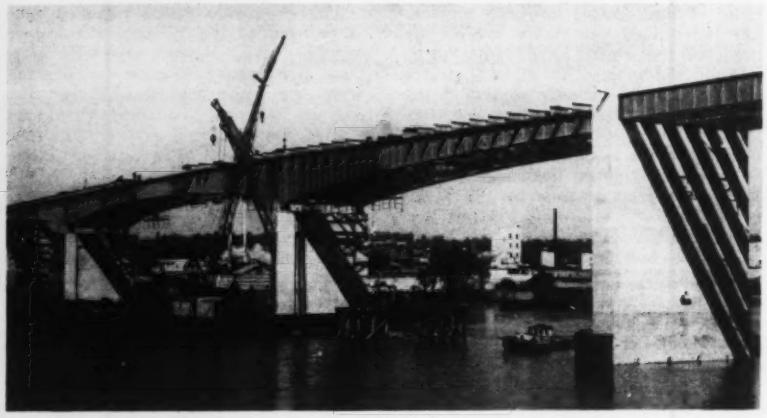
SECTION A-A

FIG. 1. Modified ribless shell type design developed for standard Army warehouse.



Model structure (one-third scale) of ribless shell similar to type used for Army warehouse was tested for a variety of loadings.

Advanced Features Mark New Vancouver Bridge



Continuous plate-girder crossing is shown during erection. Main span is 300 ft and flanking spans are each 200 ft.

The $6,000,000 Oak Street Bridge, opened to traffic in Vancouver this summer, embodies several features new to Canadian bridge construction. Its most notable feature is a 700-ft continuous riveted plate girder crossing over the river channel, the first use of this type of construction in Canada. The girders are believed to be the longest in the Commonwealth. New, too, in Canadian bridge practice is the use of an advanced type of fluorescent lighting for the bridge deck.

Spanning the Fraser River, the new structure provides a four-lane outlet from Vancouver southward to Lulu Island, the Fraser Valley, and the United States and a two-lane crossing from Lulu Island to Vancouver's International Airport on Sea Island. The four-lane high-level crossing—over 6,300 ft long—spans the river with a 700-ft continuous riveted plate girder and five 120-ft composite welded steel girders. The two-lane section, which is over 1,100 ft long, consists of a hydraulically operated swing span and prestressed concrete approach spans supported on prestressed concrete pile trestles.

Design and supervision of the entire project were carried out by Phillips, Barratt and Partners, Vancouver consultants. The general contractors were the Gilpin Construction Co., Ltd., and the Vancouver Pile Driving and Contracting Co., Ltd. The Dominion Bridge Company, Ltd., supplied and erected the structural steel. The project was built by the British Columbia Toll Highways and Bridges Authority.

Ten-Year Supply of Uranium in Sight

The United States has reached the position where a ten-year supply of uranium is in sight, according to the Atomic Energy Commission. In its twenty-second semiannual report to Congress, the AEC states that ". . . the supply from sources under contracts and from estimated increased domestic production will provide for the military and civil power development program for the next ten years."

The commission predicts that, by the end of 1957, the annual rate of production of uranium oxide will exceed 10,800 tons, and that by the end of 1958 it "should exceed 14,000 tons," with an annual value of $236 million.

Twelve mills are in operation, and ten more are either under construction or planned for the production of uranium oxide concentrates. When completed, the mills will have a combined capacity of 18,305 tons of ore per day. The report notes that during the first half of 1957 the production of U_3O_8 "totaled 4,200 tons compared to 3,400 tons for the last half of 1956 and 2,600 tons for the first six months of 1956."

Transactions of Fifth Congress on Large Dams

This is a reminder that the impressive set of Transactions of the Fifth Congress on Large Dams is now available from the U.S. Committee on Large Dams of the International Commission on Large Dams. In four volumes of some 3,500 pages, the Transactions assembles all the memorable papers and discussions (in both English and French) presented at the 1955 Paris conference. The set sells for $48 to members of the U.S. National Committee, and $60 to nonmembers. Separate volumes are not available.

In this country the Transactions will be sold only through the U.S. National Committee, which has its headquarters at 29 West 39th Street, New York 18. A coupon in the advertising section of this issue will make it easier to order both the present set and the Transactions of some of the earlier congresses.

United Air Lines Plans New Terminal at Idlewild

Plans for building a new $10,000,000 passenger terminal at New York International Airport, Idlewild, Queens, are announced by United Air Lines. Work on the 691-ft-long structure will begin this fall as part of Idlewild's $90,000,000 expansion program. It is scheduled for completion in June 1959.

Semicircular in shape, the new two-story terminal will feature a 25-ft roof overhang at the entrance side. On the field side, two concourses will lead to sixteen aircraft-loading positions. The structure will be more conventional than the recently announced $8,000,000 ultramodern parasol-roof terminal Pan American World Airways is planning to build at Idlewild (August issue, page 65).

Steel Production Sets Record in First Seven Months

More steel was produced in the first seven months of this year than in any identical previous period, according to the American Iron and Steel Institute. The record seven-month total was 69,479,547 net tons of ingots and steel for castings, an amount exceeding the best previous record by over 3,000,000 tons. The highest previous figure was 66,307,248 tons chalked up in the first seven months of 1955.

In producing this record tonnage, the steelmaking furnaces were operated for the seven-month period at an average of 89.6 percent of their annual capacity (as of January 1, 1957) of 133,459,150 tons. Back in 1955, when the previous seven-month record was set, the steel industry would have had to operate its furnaces at about 95 percent of its then-rated capacity in order to make an equivalent amount of steel.

The July output of steel was 8,896,000 tons—a decline from the June output of 9,391,402 tons. The decline is attributed in part to the July 4 holiday and to vacation schedules. Steelmaking furnaces in July were operating at 78.5 percent of rated (as of January 1) capacity.

Public Works Projects Voted $858 Million

An $858 million works appropriations bill has been voted by Congress and sent to the White House. Most of the funds will go to the Army Corps of Engineers and the Bureau of Reclamation for construction and maintenance of flood control, navigation, power, and irrigation works. Projects receiving appropriations include a number of harbor and channel deepening works in western New York State.

The present appropriation is a compromise measure lopping 2 percent off President Eisenhower's budget recommendation. In its amended form, the bill is $26,057,000 under the total voted by the Senate and $43,281,300 over the amount voted by the House. The compromise measure eliminates $500,000 originally included for planning the controversial Bruces Eddy Dam in Idaho. It also cuts from $300,000 to $100,000 an appropriation for building locks to deepen the Great Lakes-Hudson River waterway to a depth of 13 ft.

Production of Structural Shapes and Steel Plates

The supply and demand for heavy structural shapes and steel plates is coming closer into balance, said L. Abbett Post, executive vice-president of the American Institute of Steel Construction. Shipments of heavy shapes this year by the mills will approximate 6,600,000 tons while shipments of plates, it is estimated, will total 9,400,000 tons. This year shipments of structural shapes will be about 24 percent greater, and plate shipments will be 22 percent above the 7,715,000 tons shipped last year. Still further increases are expected in 1958.

According to Mr. Post, there are some local exceptions to the general picture. A fabricator, for instance, may have an inventory of structural shapes that fills his stockyard, but lack one or two pieces of a specific size. It is expected that the industry will be able to meet increasing demands for structural steel for the Federal Highway Program and other industrial and commercial construction, as there are more than adequate fabricating facilities.

The accompanying table shows shipments of heavy shapes and plates from 1953 through 1956 and the estimated shipments for this year and 1958:

Total Shipments in Net Tons

Year	Heavy Structural Shapes	Plates
1953	5,022,000	7,668,000
1954	4,501,000	5,340,000
1955	4,737,000	6,762,000
1956	5,349,000	7,715,000
1957*	6,600,000	9,400,000
1958*	6,700,000	9,700,000

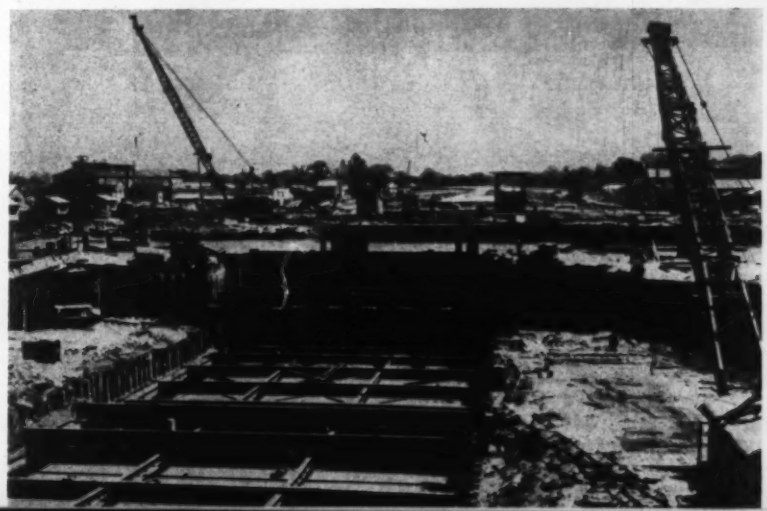
*Unofficial Estimates

Heavy Machinery Expedites Texas Turnpike Project

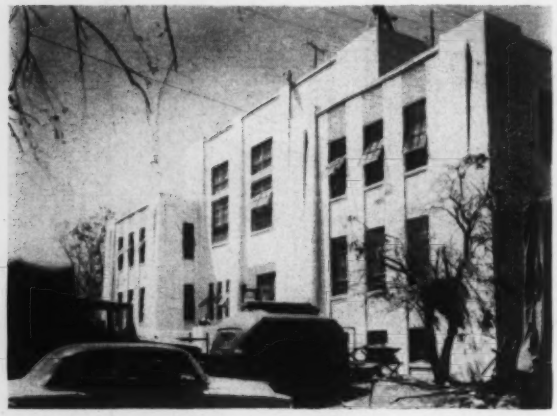
Work on the 30-mile Dallas-Fort Worth Turnpike goes on apace. A Koehring Paver-Mixer and Jaeger Strike-Off Spreader are shown in paving operations near the Dallas terminus. Portland cement concrete is being placed in two 5-in. lifts, reinforced at mid-thickness with steel welded wire fabric weighing 52 lb per 100 sq ft. Transverse joint spacing every 30 ft. The welded wire fabric (in foreground) is used to extend the service life of the pavement under heavy turnpike traffic. Average daily performance is about 4,000 sq yd. Ultimately there will be three 37-ft lanes in each direction. The third lane will be paved later. Cost of the entire project, which is expected to handle some 20,000 vehicles a day, is estimated at $58,000,000. The Worth Construction Co., Fort Worth, is the contractor on the project for the Texas Turnpike Authority. Howard, Needles, Tammen & Bergendoff are the engineers. Photo courtesy of the Wire Reinforcement Institute.

Harvey Canal Tunnel Is Opened to Traffic

Shown here in its final construction phase is the $4,354,000 Harvey (La.) Canal Tunnel, which opened in August after three years of construction. The tunnel — four lanes wide and 1,080 ft long — replaces a now-inadequate bascule bridge across the canal, which provides waterway passage from the Mississippi River at Harvey to the Gulf of Mexico. It was built in two sections so as not to interfere with canal traffic. Some 3,000 pieces of steel sheeting, rented from the L. B. Foster Company, were driven to form a cofferdam from the east bank to the mid-point of the canal. When construction of that half of the canal was completed, the cofferdam was pulled and the same sheeting used for a different cofferdam on the west bank. In the photo (west half of the tunnel is in the foreground) the concrete roof has been poured and workers are preparing to waterproof the structure. Center installations shown are ventilation shafts for the west portion. The project is a joint venture of R. P. Farnsworth and Company, Inc., and the Mason and Hanger-Silas Mason Company, Inc. An article on the construction of the tunnel is scheduled for an early issue.



Concrete Courthouse Saves Hundreds from Hurricane



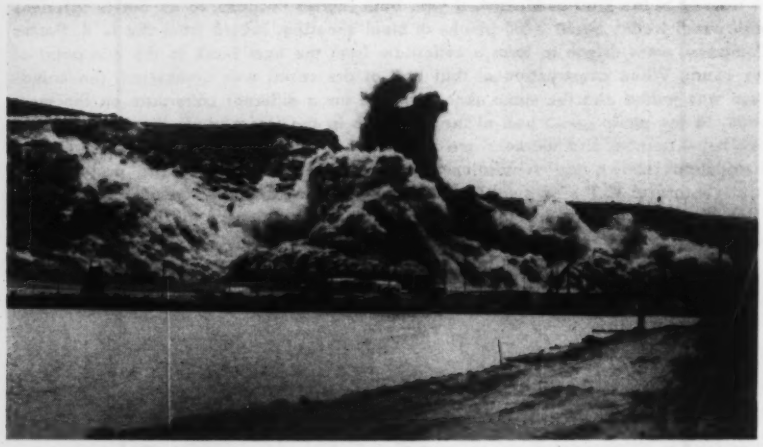
This photo of the reinforced concrete courthouse at Cameron, taken four days after the hurricane and tidal wave, gives little evidence of the disaster that destroyed most of the town.

Most news accounts of Hurricane Audrey and the accompanying tidal wave, which wiped out 90 percent of the town of Cameron, La., mentioned the Cameron Courthouse that served as a haven for hundreds of people during the disaster. Built exactly twenty years ago, the reinforced concrete structure was especially designed as a refuge during the frequent hurricanes that plague the Cameron area of the Louisiana coast. While exact figures are not available, it is estimated that between 600 and 1,000 people escaped death by taking shelter there. Water had filled the basement and risen to the top of the 7-ft-high front steps, but the base of the building was sound and only one window was broken. As the only habitable structure in the area, the courthouse became the center of rescue and clean-up operations.

In planning the building, careful consideration was given to making it resistant to fire, hurricane, and tidal wave. Wide footings were extended down through sand and shell to hard clay. The reinforced concrete walls were 12 in. thick, buttressed by battered pylons and braced by concrete floors and roof. Total cost of the structure was only $125,000.

Sadly enough Herman Duncan, the architect who planned so well, did not live to see the superb performance his building gave. He died a few months before the disaster.

World's Largest Blast Demolishes Utah Mountain



Largest, non-atomic industrial blast in history—fired at Little Valley, Utah, on July 21 by Morrison Knudsen Company, Inc.—shatters a mountainside 1,300 ft wide and 200 ft high. Detonation of 1,790,000 lb of Atlas blasting agent and Atlas 60 percent Extra dynamite produced over 1,600,000 cu yd of broken rock which the construction company will use for fill in the 13-mile causeway it is building for the Southern Pacific Railway across Great Salt Lake (June issue, page 95). With construction rather than destruction its goal, the explosion was carefully controlled. It is shown here at the peak of its power.

Members Honored at Reclamation Meeting

Regional officials of the U.S. Bureau of Reclamation met in San Francisco during the World Prestressed Concrete Congress (page 86) to plan the Bureau's 1958 construction program. A highlight of the opening session was the presentation of awards honoring 200 years of service rendered by eight engineers.

The top record of 45 years had been tallied by L. N. McClellan, assistant commissioner and chief engineer for the Bureau at Denver, Colo. Next was the record of 40 years attained by Clyde Spencer, of Sacramento. Others honored were E. O. Larsen, Salt Lake City, 37 years; F. M. Clinton, Billings, Mont., 23 years; and H. T. Nelson, Boise, Idaho, W. H. Taylor, Boulder City, Nev., Robert W. Jennings, Amarillo, Tex., and R. J. Walter, Jr., Denver, who have given 22 years of service each.

The service awards were presented by Bureau Commissioner Wilbur A. Dexheimer. Mr. Dexheimer is a member of the Society, as are the eight engineers honored.

Venezuela to Build Tunnel to the Sea

Another highway and tunnel project connecting Caracas with the Caribbean Sea is being planned by the Venezuela Ministry of Public Works. The project will involve construction of 12 miles of highway and a 3½-mile-long tunnel under Avila Mountain, the 7,000-ft-high range that separates Caracas from the coast. It will be started in January.

The Ministry of Public Works is currently asking for construction bids on the tunnel, which will carry two 33½-ft highways of three lanes each. Ventilation will be provided by 96 large fans—half of them exhaust fans. The two ventilation buildings, from which shafts will lead into the tunnel, will be located above the Caracas entrance to the tunnel at an altitude of 1,000 ft. Each of the two ventilation shafts will be half a mile long and 25 ft in diameter. At each tunnel entrance two six-story buildings will be required to house the administration and maintenance services.

From Canon Carabelleda, the western terminus of the tunnel, a new highway will be built to link that structure with the existing coastal highway. The total length of the system including the tunnel will be 15½ miles.

Designed primarily for pleasure traffic, the new tunnel and highway are located at the eastern end of Caracas. At present all traffic, both pleasure and commercial, must reach the shore via the Autopista at the western edge of the city. On weekends this results in bad traffic jams. The new tunnel will have a capacity of 2,400 cars per hour in each direction.

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

Salted footprints, decades old, led him to his goal

Since 1904 Andrew Nelson, dean of federal surveyors, has surveyed some seven million acres. Laid end to end these linear surveys would girdle the earth—and then some.

In the Great Salt Lake Desert area in 1926, Nelson had to tie his survey into the area to the north, surveyed over a quarter century earlier. *His problem:* how to find posts planted in 1870?

For Nelson, wise in desert procedures, this was no great problem. Scouting northward he found the 26-year-old footprints of a five-man crew, still preserved in salt. Following them to the lost post markers, he left his own, perhaps for future surveyors to find and follow decades hence.

Nelson has several times walked 45 miles in one day. He has used snowshoes, skis, toboggans, canoes, horses—and riding 60 miles in a day, muleback, is all in a day's work for him.

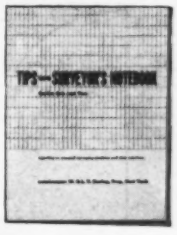
As a follower of the surveyor's "straight and narrow" for half a century, he has worked in heat that burst thermometers, and cold bitter enough to quickfreeze human lungs. During his wilderness work he has feared only one animal and claims a speed record for the mile on snowshoes fleeing from the threat of a pack of wolves.

Surveyors often come upon dramatic evidence of past history. Nelson's most interesting find was three wagons, abandoned by the ill-fated Donner Expedition in 1846. In the old wagon traces, the bones of oxen lay as they had been abandoned eighty years earlier—fully preserved in salt. Wheel tracks still remain for anyone to see.

Andrew Nelson, cadastral engineer and a dean of American surveyors, sights through his Gurley Telescopic Solar Transit.

As he is one of the last of a vanishing fraternity of surveyors, Nelson's views on instruments are valuable. He says: "The Gurley Telescopic Solar Transit can save countless hours when re-running a misclosure. It is invaluable for checking on precise traverses. For large-scale precision surveying, *nothing equals a Gurley.*"

"Tips from The Surveyor's Notebook": *We have collected the most helpful, most discussed pages from Series One and Two of "The Surveyor's Notebook" in one 20-page book. These valuable field suggestions will help you use your own instruments with greater success. Write for your free copy.*



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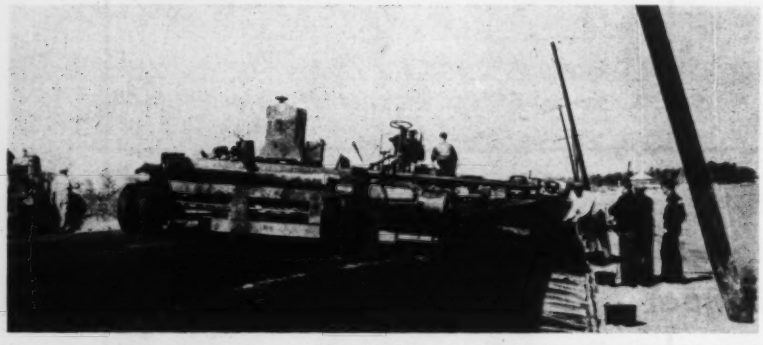
Fabric-in-Asphalt Strengthens Causeway Slopes



Causeway linking the southern terminus of Maryland State Road 5 to Point Lookout, where the Potomac River flows into Chesapeake Bay, was rebuilt this past winter and its sea walls strengthened against erosion with fabric-in-asphalt. Here an Apsco shoulder spreader is laying a 2-in. top course of asphaltic concrete on the causeway slope. Welded wire fabric (right foreground) is fastened between sheeting and batten (out of sight, under the first course of asphalt) and is bent over onto the first course. The fabric is expected to prevent erosion of the slope caused by sand and water action, and to hold the slope together despite undercutting. Pilings, to right of fabric, are driven to ten-ton capacity and back up cut-off wall construction, which is designed to reduce erosion. Wire Reinforcement Institute photo.

N. G. Neale's COLUMN

R. Robinson Rowe, M. ASCE

Something amused Joe Kerr. He knew the Professor was going to ask him when California would be all used up, and he chuckled in anticipation. But when the question came, he smothered a giggle and solemnly announced, "In A.D. 2022, and I figured that with the Bat Formula."

"Bat Formula?"

"I call it that for short. A buddy of mine is a doc of biology—knows all about the birds and the bees, the bugs, the beetles and the bats. He's batty about bats and raises them in his belfry. He started with two and kept a record of the progeny. At first the number seemed to double every 7 months, but as the belfry got crowded, more and more batlings died young, which he called 'restricted growth' and derived the bats-in-belfry formula:

$$x = kx(l-x) \quad \ldots\ldots\ldots\ldots (1)$$

"When you called the subdivision and paving of California 'restricted growth', I asked Doc how to use his Bat Formula, and he integrated it to:

$$\log x/(l-x) = kt + C. \quad \ldots\ldots (2)$$

For subdivision, you said $x = 0.02$ when $t = 0$, so

$$\log x/(l-x) = kt - \log 49$$

and that x = 0.03 when t = 10 yr, so

$$\log x/(l-x) = 0.1\ t \log 147/97 - \log 49 \quad \ldots\ldots\ldots\ldots (3)$$

Similarly for pavement, y, you said $y = 0.01$ when $t = 0$ and $y = 0.02$ when $t = 10$, so

$$\log y/(l-y) = 0.1\ t \log 99/49 - \log 99 \quad \ldots\ldots\ldots\ldots (4)$$

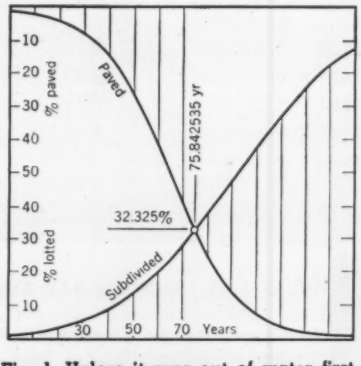


Fig. 1. Unless it runs out of water first, on Oct. 5, 2022, at 6:39:42 p.m., P. D. T., all of California might be paved or subdivided.

"Now x and y are the portions of the area of California subdivided and paved, respectively, and California will be all used up when $x + y = 1$, which I solved graphically (Fig. 1) by solving for x and y every 10 yr and plotting against time. By plotting y down from the top, the two curves crossed at the answer, 75 yr from 1947, or in A.D. 2022."

"Joe," conceded Cal Klater, "should be congratulated for clever plotting and nice use of a batty buddy, but he should have solved (3) and (4) for x and y, equated their sum to unity and solved for the time t. This comes out very simply to:

$$T = \frac{10 \log 4851}{\log 297/97} = 75.842535 \text{ yr.}$$

If the data was given for Jan. 1, 1947, and 1957, then California will be all used up at 6:39 :42 p.m. P. D. T. on Oct. 5, 2022."

"Which just proves," agreed the Professor, "that figures don't lie, but only liars extrapolate. My problem worried one hydraulic engineer because I didn't reserve any area for reservoirs and a ranch engineer who decried the butchering of orange groves for immigration of Iowans, but an applauding Texan says 'Hurry it up!'

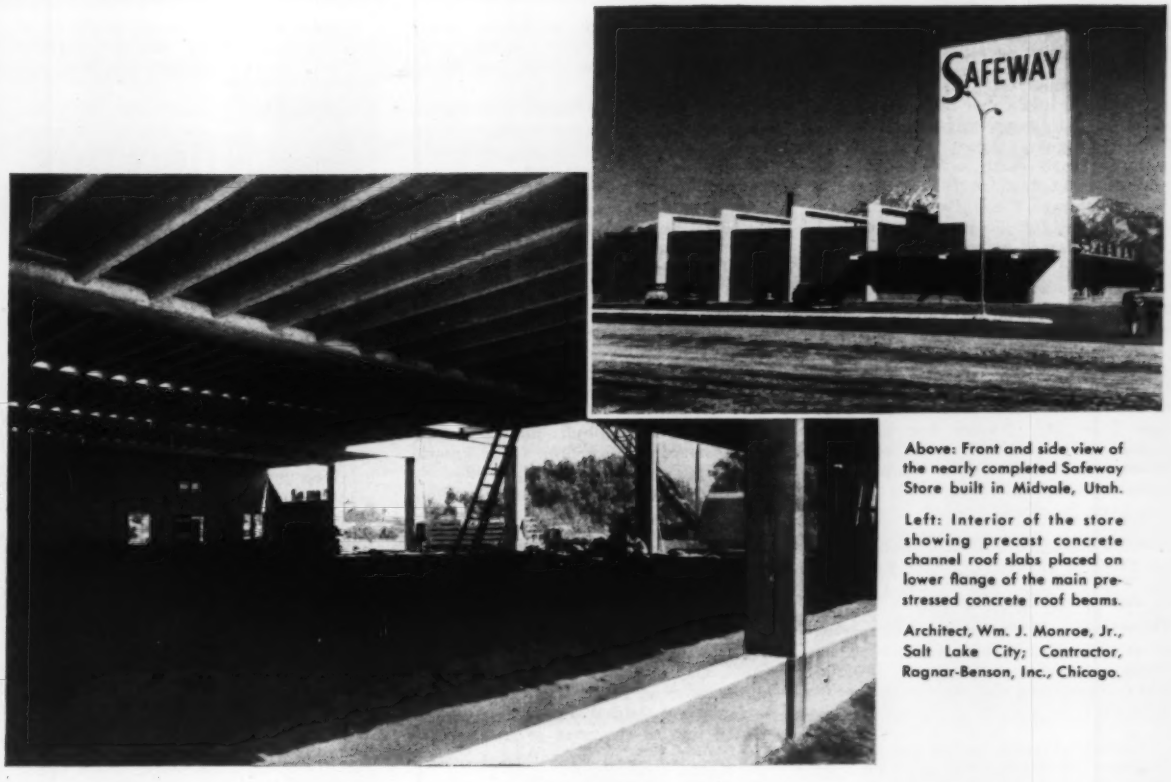
"And while we're on the subject of California, here's a tout's rating of 5 frogs being trained for the next annual jump in Calaveras County. A jump is the closing distance between the beginning and ending of 3 successive hops. Marksman hops 5 ft straight toward his trainer. Sidewinder hops 6 ft, but always deflects 45 deg from his last course. Hex hops 7 ft, but deflects 60 deg. Quad hops 8 ft, but deflects 90 deg. Random hops 10 ft, but is blind and goes in any direction. Which is most likely to win?"

[Cal Klaters were: Richard Jenney, Dont'T (Don P. Thayer), David V. Messman, and Donald E. Milks. Guy C. Thatcher added a correct solution to the June problem.]

Marine Division Set Up In Corps of Engineers

To coordinate its widespread dredging activities the Corps of Engineers has established a Marine Division in the North Atlantic Division Office in New York City. The division will coordinate all operations including new vessel construction and maintenance and repair work. The present Marine Design group located in the Philadelphia District Engineer Office will also come under the jurisdiction of the new organization, which is headed by Henry G. A. Hayward, former chief of the Plant and Special Projects Branch of the North Atlantic Division.

Clarence C. Burger, M. ASCE, of the office of the Chief of Engineers in Washington, has been assigned to set up and supervise the Marine Division.



Above: Front and side view of the nearly completed Safeway Store built in Midvale, Utah.

Left: Interior of the store showing precast concrete channel roof slabs placed on lower flange of the main prestressed concrete roof beams.

Architect, Wm. J. Monroe, Jr., Salt Lake City; Contractor, Ragnar-Benson, Inc., Chicago.

Super Mart's 108 ft. clear span made possible by Precast, Prestressed Concrete Beams

The Safeway Store Building in Midvale, Utah, obtained a clear floor area 108′ wide by 130′ deep through the use of only five precast, prestressed concrete beams. The beams, cast on the job site, were placed to give a 16′ space above the finished floor in the main store area.

The roof required about 13,500 sq. ft. of precast concrete channel slabs with conventional reinforcement. These channels, 2′ wide with 10″ legs, were placed on the lower flanges of the main prestressed beams. This allowed the prestressed concrete beams to stand boldly above the finished roof line to produce a dramatic architectural effect.

Structures designed to utilize precast and prestressed units can be built for any usage and to conform with any applicable local building codes. Like all concrete structures they offer many advantages: great strength, extra long life, very low maintenance cost and true *low-annual-cost* service. In addition, such structures provide great resistance to destructive natural forces such as storms, decay, termites and especially fire.

For additional information on construction utilizing precast and prestressed concrete beams write today for our helpful free illustrated literature. Distributed only in the United States and Canada.

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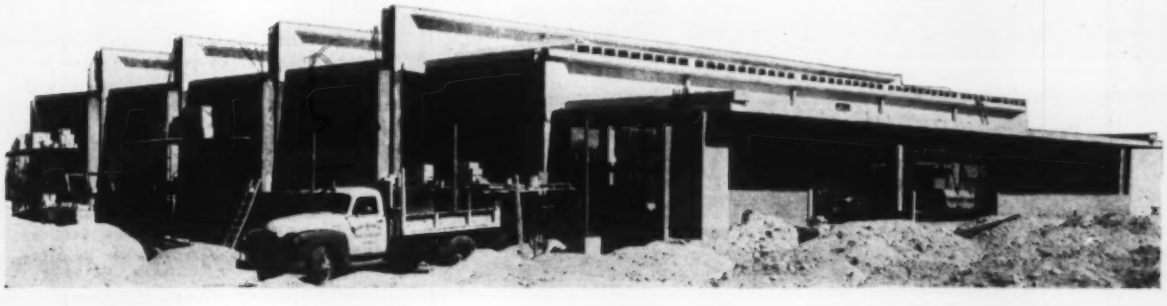

News of Engineers

(Continued from page 32)

E. C. Itschner, Major General, Corps of Engineers and Chief of Engineers, is directing the army's participation in Project Vanguard. Army teams left recently to man earth satellite tracking stations extending from Fort Stewart, Ga., to Santiago, Chile. General Itschner is responsible for the establishment and operation of a tracking system, and for provision of communication facilities from the tracking stations to the data processing center operated by the Navy in Washington, D. C.

David L. Narver Jr., engineer with Holmes & Narver Inc., has been promoted to assistant vice president of that firm. Mr. Narver has held increasingly responsible positions with Holmes & Narver since joining the company in 1942 following his graduation from Stanford.

Bruce Buchanan has been elected vice-president of the J. G. White Engineering Corporation, New York City, in charge of the Reports and Appraisals Department. With White Engineering since 1942, Mr. Buchanan has been actively associated with many international engineering and construction projects.

Ralph W. Powell, for the past 30 years professor of engineering mechanics at Ohio State University, has been appointed professor emeritus. In September he will go to Kansas University as visiting professor in applied mechanics. During the summer he has carried on research in open channel flow at the Rocky Mountain Hydraulic Laboratory at Allenspark, Colo.

Philip C. Rutledge, consulting engineer with Moran, Proctor, Mueser and Rutledge, New York City, has been awarded an honorary doctorate of engineering degree by Purdue University. Dr. Rutledge, teacher, author, and research engineer, was cited for "outstanding contributions" to his field.

Charles S. Howard has retired after 37 years as chemist with the Water Quality Branch, Water Resources Division, U. S. Geological Survey. Mr. Howard, a pioneer in investigations of water quality, has written many papers on his findings. He is particularly well known for his contributions to knowledge of the sediment and chemical characteristics of the Colorado River.

William C. Turnbull announces the formation of his own firm, to be known as W. C. Turnbull Co. with an office at 520 Junction Avenue, Toledo, Ohio. Mr. Turnbull, formerly Toledo sales engineer for Armco Drainage and Metal Products, Inc., will serve as a sales engineer and manufacturers' representative.

Howard B. Blodgett, chairman of the Department of Civil Engineering at the University of Nevada, has been promoted to dean of the College of Engineering. **Prof. John A. Bonell Jr.** has succeeded him as chairman of the department.

Frank B. Campbell, staff member of the U. S. Army Engineer Waterways Experiment Station at Vicksburg, Miss., attended the Seventh Congress of the International Association for Hydraulic Research at Lisbon, Portugal. Mr. Campbell is chief of the Station's Hydraulics Analysis Branch.

Gordon L. Burt, presently in charge of the Portland (Ore.) sewage disposal plant, has been appointed city engineer. Mr. Burt has worked as draftsman and engineer in Indiana, Wisconsin and Illinois; was assistant resident engineer at Hammond (Ind.), and an instructor in civil engineering at Rose Polytechnic Institute. He has also served as stress analyst for Consolidated Vultee Aircraft Corporation assisting in design of the cargo version of the B-36.

Gordon L. Burt

Leroy Martin, formerly city engineer of Fresno, Calif., announces the establishment of a consulting engineering practice in the San Francisco Bay area. The new firm, to be known as the AAA Engineering Company with headquarters in Fremont, will specialize in structural and municipal engineering.

Frank E. Bosland has resigned as assistant to the head civil engineer of the Tennessee Valley Authority to accept a position as chief highway engineer of the Mid-South Engineering Company in Knoxville. Prior to his association with the TVA, Mr. Bosland was employed by the New Jersey State Highway Department and the Passaic County Engineering Department.

Robert H. Dodds has joined Gibbs & Hill, Inc., New York City, as project engineer. For the past two years he has been a development engineer with Lockwood, Kessler and Bartlett, Port Washington, N. Y. Mr. Dodds was a Lieutenant Commander in the Navy Civil Engineer Corps during the war and has been associate editor of *Engineering News-Record.*

Harry Seitz, formerly designing engineer of bridges and buildings with the B. & O. Railroad, has been named structural engineer in the Engineering Department at Baltimore. Mr. Seitz, educated at Johns Hopkins University, began his railroading career with the B. & O. in 1920.

Edward C. Cardwell has been named assistant manager of the Central Sanitary Division of Dorr-Oliver Inc., Stamford, Conn. Mr. Cardwell has been connected with the Division since 1949.

John Orth Cook has retired as assistant manager of real estate for the United States Steel Corporation and begun a consulting practice with particular reference to engineering control of large assemblies of land. His headquarters are at 99 Newburn Drive, Pittsburgh, Pa. As chief engineer of the real estate division for many years, one of his accomplishments was the acquisition of the Fairless Work's site at Morrisville, Pa.

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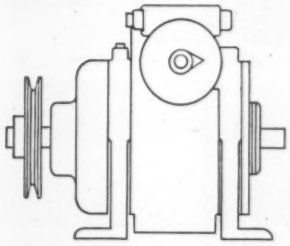
Once . . . just once . . . you run your original drawing through your Ozalid machine with a piece of Ozalid intermediate material. Then file away your drawing. Your Ozalid intermediate copy becomes a duplicate original—all set to give you important benefits.

Take design changes, for instance. With an Ozalid intermediate print, there's no need to trace or redraw the original design. Changes are as easy as 1-2-3 . . . just see below!

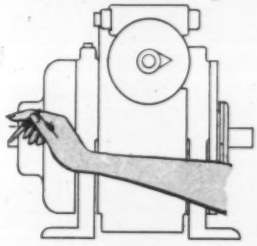
Not only are Ozalid intermediate prints exact copies of your original—they can be *better* than the original. Faded or weak areas are intensified.

There's an Ozalid intermediate material for every drafting room need: film, translucent paper, and cloth.

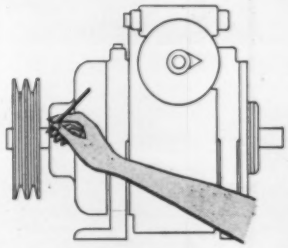
See for yourself how quick and easy you can make design changes with Ozalid intermediates. Contact your local Ozalid man—his name is in the phone book—or write for free folder. Write to Ozalid, Dept. BB-9, Johnson City, N. Y. In Canada: Hughes Owens Co., Ltd., Montreal.



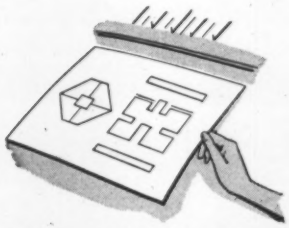
1. This is an Ozalid intermediate (translucent) print of the original drawing.



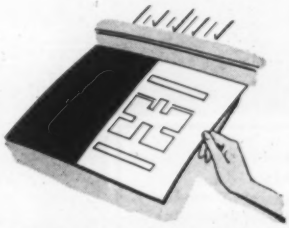
2. Draftsman eradicates obsolete lines with Ozalid Corrector Fluid.



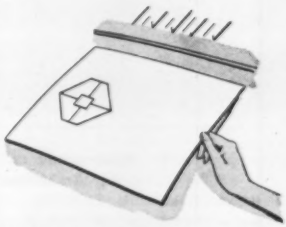
3. New design is drawn in. Prints can now be run from this intermediate "master."



1. Expose original drawing in the usual manner on Ozalid intermediate paper, cloth, or foil. But do not develop!



2. Cover all printed yellow lines which are to be retained on the intermediate with a mask of black opaque paper—re-expose in Ozalid machine. The light will remove all obsolete details left uncovered.



3. Develop the intermediate . . . and you have a clear, up-to-date "framework" to which you add the new design. Use this intermediate master to produce prints.

OZALID®

Products for Design

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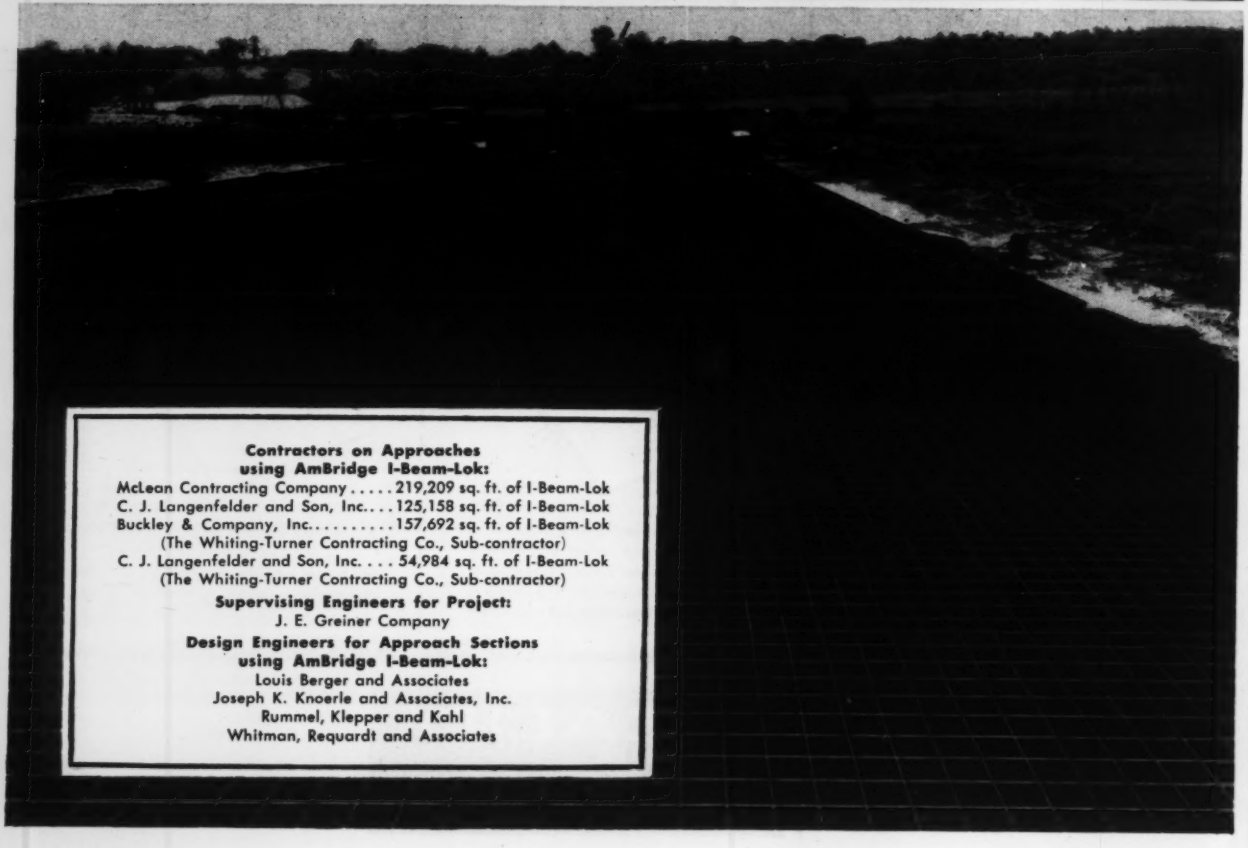
on approaches to Baltimore's new



Contractors on Approaches
using AmBridge I-Beam-Lok:

McLean Contracting Company..... 219,209 sq. ft. of I-Beam-Lok
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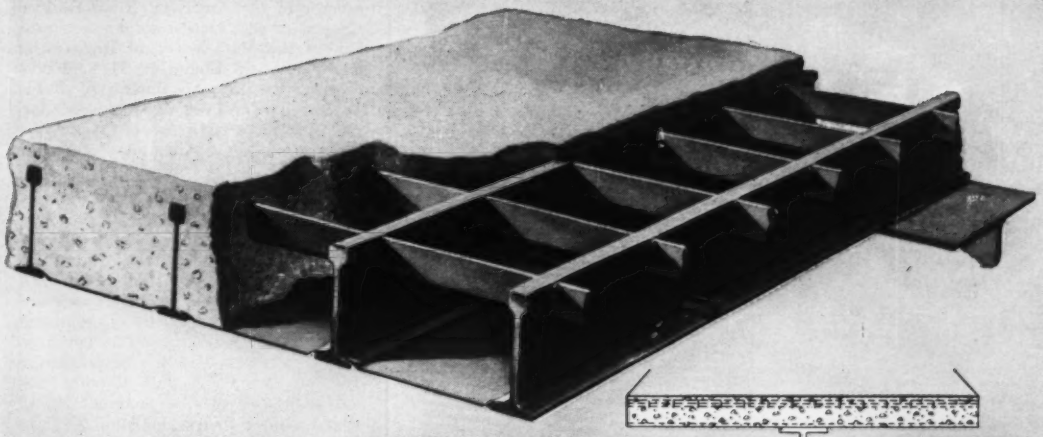
Buckley & Company, Inc..... 157,692 sq. ft. of I-Beam-Lok
(The Whiting-Turner Contracting Co., Sub-contractor)
C. J. Langenfelder and Son, Inc. . . . 54,984 sq. ft. of I-Beam-Lok
(The Whiting-Turner Contracting Co., Sub-contractor)

Supervising Engineers for Project:
J. E. Greiner Company

Design Engineers for Approach Sections
using AmBridge I-Beam-Lok:
Louis Berger and Associates
Joseph K. Knoerle and Associates, Inc.
Rummel, Klepper and Kahl
Whitman, Requardt and Associates

Patapsco Tunnel—

557,043-sq.-ft. USS AMBRIDGE I-BEAM-LOK concrete-filled flooring



designed for composite **T-BEAM** *action*

BISECTING the municipal area from southwest to northeast, Baltimore's $130 million Patapsco Tunnel expressway is nearing completion.

Due to be opened before the end of 1957, this broad new 4-lane cross-town route runs 17.6 miles through congested waterfront and residential districts on viaducts and through a 7,650-ft. twin-tube tunnel deep beneath the busy harbor traffic of the estuary.

To take care of the heavy traffic this new expressway will get . . . and to hold weight and maintenance to a minimum, much of the roadway flooring on the approach viaducts is of the solid grid type—557,043 sq. ft. of which is USS AmBridge 4¼" I-BEAM-LOK concrete-filled flooring designed for composite T-Beam action. To provide still greater durability, a 2" blacktop wearing surface was applied to the ¾" concrete overfill.

The composite T-Beam action means that the floor slab (I-BEAM-LOK) and the supporting steel stringers are so welded together, making use of the 4¼" beams as shear connectors, that they cooperate as a single structural member in resisting some dead loads and all live loads. This saves a substantial amount of structural steel and facilitates erection.

The modern bridge flooring for today's heavy traffic

USS AmBridge 4¼" concrete-filled I-BEAM-LOK Flooring weighs only 58 lbs. psf. using a lightweight aggregate concrete with a ¾" overfill of regular concrete. Because of the strength of this lightweight floor, the supporting members can be spaced on 8' to 9' centers and still safely provide for H-20 loadings.

Completely fabricated units ready to install are delivered to the job site in the proper erection sequence. Top-side erection eliminates scaffolds and forms. And, since the pans are already installed, the concrete filler can be poured as the job progresses with little or no interference with other phases of construction.

Concrete-filled I-BEAM-LOK Flooring is available in 3" depth (weighing 47 lbs. psf.) as well as in the 4¼" depth (weighing 58 lbs. psf.). Open-type I-BEAM-LOK is available in 5" depth which weighs only 18.8 lbs. psf.

For detailed information about the advantages of this lightweight steel bridge flooring, contact the office nearest you, or write direct to Pittsburgh. Ask for a copy of our 32-page catalog.

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USS AMBRIDGE I-BEAM-LOK BRIDGE FLOORING

UNITED STATES STEEL

Weight-reducing system for concrete slab construction!

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Sonoco SONOVOID Fibre Tubes are specifically developed for use in wall, floor, roof or lift slabs . . . and in concrete piles.

The hollow slab system in concrete construction saves money and materials. The low-cost Sonoco SONOVOID Fibre Tubes displace low-working concrete at the neutral axis and eliminate dead weight without impairing structural strength!

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Use Sonoco SONOVOID Fibre Tubes in poststressed or prestressed units or units cast in place. Contractors everywhere have saved concrete and reinforcing steel through the use of these fibre tubes in the construction of schools, office buildings, bridge decks, plants, and many other structures.

Sizes to 36.9" O.D. up to 48' long. Order in specified lengths or saw to requirements on the job. Metal end closures available.

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DECEASED

Ben T. Collier (M. '50), age 66, retired state aid engineer for the Mississippi State Highway Department, Jackson, died recently. Active in professional affairs, Mr. Collier had served as director of the Mid-South Section, president and director of the American Road Builders Association and vice-president and president of the State Board of Registration for Professional Engineers. He had been a consultant for the Bureau of Public Roads on federal aid and the secondary road system for Mississippi. Mr. Collier was a graduate of Alabama Polytechnic Institute.

Walter Hanna Dunlap (A.M. '15), age 74, president of Southdown Shores Inc. Waterfront Subdivision, Edgewater, Md., died on July 7. At one time engineer with the Public Utilities Commission, Mr. Dunlap was more recently employed by the Federal Power Commission as chief of the Plans and Reports Unit and as public utility analyst. He received his B.S. and C.E. from Washington and Lee University.

Lawrence Lowell Flint (A.M. '39), age 60, retired major in the Corps of Engineers, died recently. Prior to his army service, Major Flint was managing director of the Iowa Engineering Society. He was also a research assistant at the University of Minnesota Experimental Engineering Laboratory. Major Flint completed his undergraduate and graduate work at Tri-State College.

Howard C. Ford (M. '20), age 75, a structural engineer with Midwest Steel & Iron Works Co., Denver, Colo., died recently. Mr. Ford had been with the firm since 1926, serving first as draftsman. Early in his career, he taught at the University of Colorado, from which he had received his B.S., M.S. and C.E. degrees.

Henry Gerharz (M. '20), age 78, retired project engineer for the U.S. Indian Irrigation Service at Wind River Wyo., died recently. Mr. Gerharz had also been project engineer for the Service on the Flathead Project at St. Ignatius, Mont. Earlier he was resident engineer for the Montana Highway Commission at Billings, and for some years had a consulting practice at Great Falls, Mont.

Louis Goodman (M. '48), age 75, retired consulting engineer of Miami Beach, Fla., died recently. For many years, Mr. Goodman was an engineer for

(Continued on page 114)

TOOK LESS STEEL TO BUILD BECAUSE IT'S WELDED

FABRICATED and erected by arc welding, this San Francisco Skyway illustrates the savings in steel and construction cost possible today by the correct use of welded bridge designs. All columns are fabicated from standard rolled shapes. Maximum strength per pound of steel is assured at low cost because welded design permits steel to be placed economically where it has the most efficient load carrying ability.

Designed under the direction of Wendell F. Pond, Senior Bridge Engineer and Supervisor of Bridge Design for the State of California.

Bridge Designers! Aids available on welded bridge design are:

Bridge Design Seminars now held regularly at the Lincoln plant in Cleveland, Ohio.

New "Procedure Handbook of Arc Welding Design and Practice". Available at small cost, it has 466 pages devoted to structural design.

"Studies in Structural Arc Welding", design bulletins sent regularly to engineers at no cost.

For additional information write . . .

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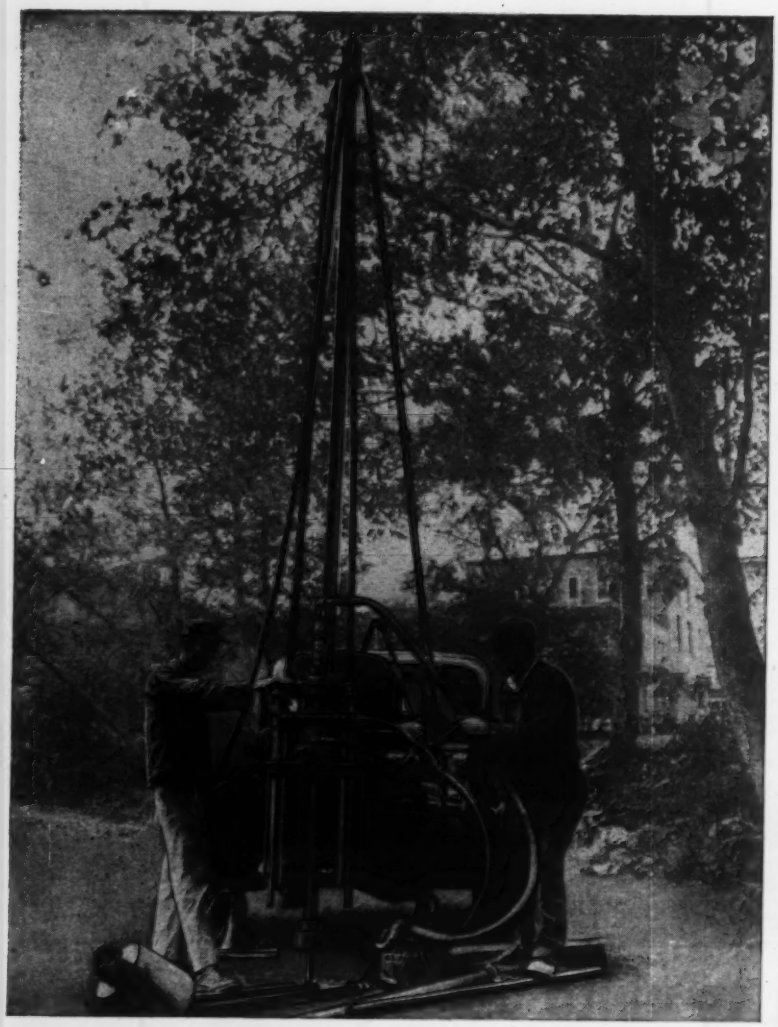
The World's Largest Manufacturer of Arc Welding Equipment

When welding saves steel

Has simpler design

Yet costs less

WHY use anything but welded construction



SPRAGUE & HENWOOD MAKES THE EQUIPMENT FOR THE SOIL SAMPLE OR ROCK CORE YOU WANT

With the earth-shaking increase in construction, you need efficient, versatile sampling and coring equipment.

Sprague & Henwood, Inc., a leading manufacturer of all types of equipment for foundation investigation, has just the right type for you!

Illustrated above, on location, is a truck-mounted Sprague & Henwood Model 30 Core Drill Machine. On this foundation project this machine is recovering both good samples and good cores. The soil samples have already been recovered from this boring and now the machine is being used to core rock. Because of the versatility and economy of this machine it is becoming a favorite of many contractors and other users throughout America.

The proper machine alone will not give you the good soil samples and rock cores you want. You need just the right samplers, accessory equipment and coring bits. If you need a sampler to determine only the general classification of the sub-surface soils or a sampler to secure samples for testing in a soils laboratory, Sprague & Henwood has it. There is a complete line of accessory equipment and the best in "Oriented" Diamond Bits awaiting you. One call . . . to SPRAGUE & HENWOOD, Inc., and your drilling equipment needs can be met.

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Deceased

Continued from page 112

the New York City Board of Water Supply, and earlier had been assistant engineer in the City Department of Finance. At one time he had a consulting and building practice in New York. Mr. Goodman was a graduate of Columbia University.

Frank Earle Harrison (M. '27), age 64, design engineer for the New Rochelle (N. Y.) Department of Public Works, died recently. Mr. Harrison had served as chief transitman for the New York Central Railroad; Schenectady (N. Y.) city engineer; and vice-president of Strachan-Harrison Inc. He was a graduate of Rensselaer Polytechnic Institute.

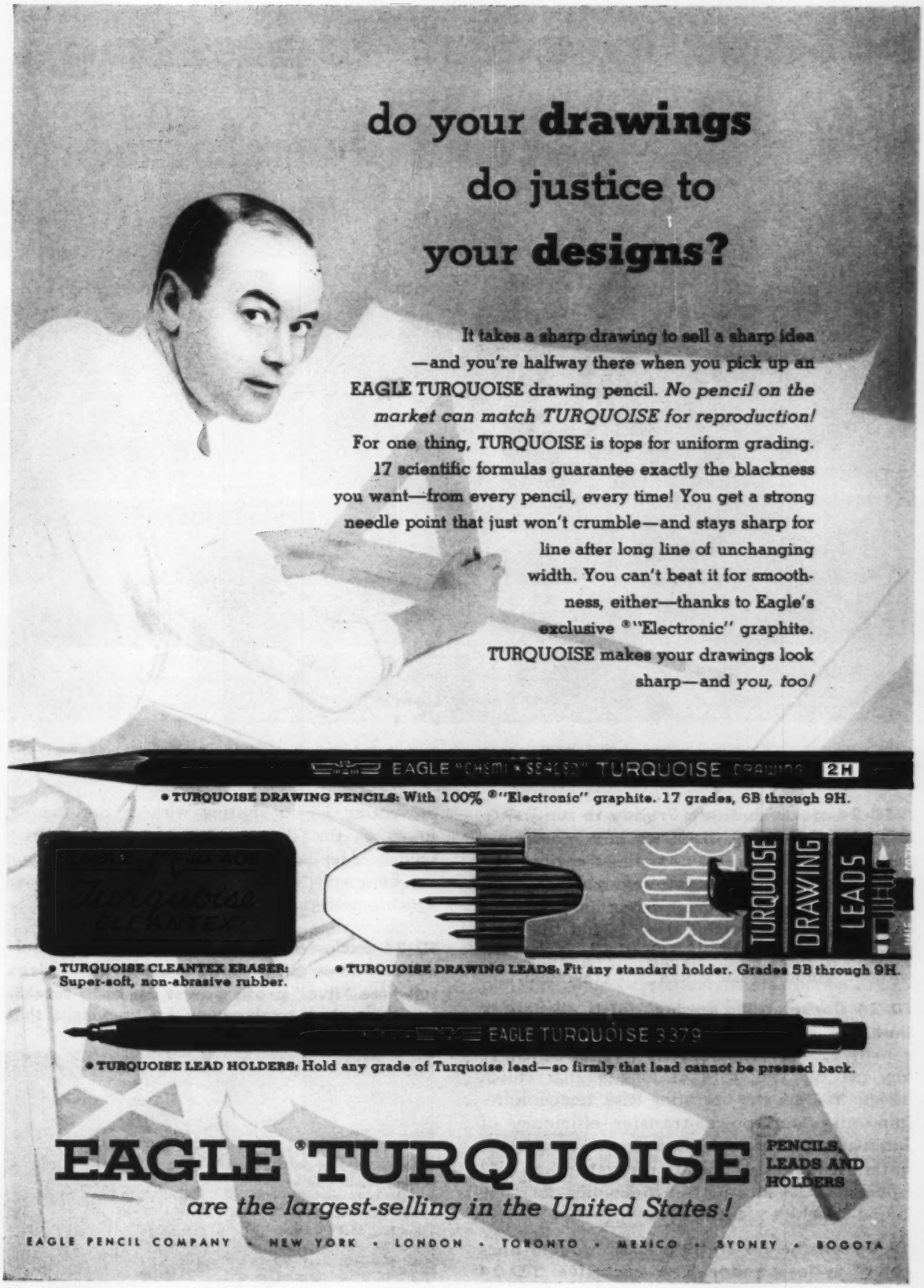
Harry A. Helling (M. '26), age 72, retired engineer of Liberty, N. Y., died there on July 17. Early in his career, Mr. Helling was an engineer for the New York State Highway Department, and was responsible for the design of the Storm King Highway and other important roads. During World War II, Mr. Helling served the U. S. government in the development of the atomic bomb, and held three patents in the field of atomic design. Mr. Helling was educated at Ohio State University.

James Hansen Hjul (A.M. '20), age 75, for many years a prominent construction engineer in San Francisco, died there recently. Mr. Hjul was a graduate of the University of California.

Gilbert A. Hunt (M. '37), age 65, civil engineer for Ebasco Services, Inc., New York City, died at his home in Maplewood, on July 16. Mr. Hunt had been with Ebasco since 1936. He served his country in both World Wars, as a captain in the Army in World War I and as a captain in the Navy in World War II, on active duty from 1940 to 1945. He specialized in dam construction and hydraulic engineering: his last assignment was in connection with a hydroelectric installation on the Congo River. Early in his career, Mr. Hunt taught mathematics at the University of Michigan. He was graduated from Massachusetts Institute of Technology in 1917.

Earnest D. Kahlert (A.M. '19), age 73, senior structural engineer of San Francisco, died on June 1. During his long and varied career, Mr. Kahlert worked as designer, planner, draftsman and supervisor for a number of firms, including Charles Mayer, the D. P. Robinson Co., and Post & McCord, all of New York City. He was graduated from Rose Polytechnic Institute.

Continued on page 118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It takes a sharp drawing to sell a sharp idea —and you're halfway there when you pick up an EAGLE TURQUOISE drawing pencil. No pencil on the market can match TURQUOISE for reproduction! For one thing, TURQUOISE is tops for uniform grading. 17 scientific formulas guarantee exactly the blackness you want—from every pencil, every time! You get a strong needle point that just won't crumble—and stays sharp for line after long line of unchanging width. You can't beat it for smoothness, either—thanks to Eagle's exclusive ®"Electronic" graphite. TURQUOISE makes your drawings look sharp—and you, too!
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How a cost-beating, can "unbind"

A TD-24 starts and gets "ready to run," seconds-fast. Morning, noon, or any other time you shut down the TD-24's diesel engine, you restart in seconds—and save yard-moving, wage-costing minutes! Exclusive International gasoline-conversion diesel starting does it—and the combustion-heated engine is ready to run as a diesel, without "gumming the works" with raw fuel!

TD-24 Cerametallic engine clutch eliminates time loss and upkeep cost of temperature-sensitive, "service-nervous" type clutches! You get the simplicity of long-familiar clutch design. You get the operating ease, temperature-immunity, and power-transfer efficiency of International Cerametallic facings. You get the instant readiness to operate perfectly when cold—plus heat-defiance for clutch-mauling jobs like 'round-the-clock shuttle-dozing.

TD-24 on-the-go shifting is a "double-barreled" cycle-speeder. The exclusive TD-24 two-speed planetary system gives instant, stall-preventing Hi-Lo shifting without declutching, in either the Torque-Converter or Gear-Drive models. And in the Gear-Drive model, you get two-direction "no-stop" shifting with exclusive synchromesh transmission.

TD-24 exclusive Planet Power steering eliminates load-limiting "dead-track drag"—gives full-time "live" profit power on both tracks. It's more than total engine hp or weight that

"The TD-24's 2-speed track steering holds you in 'dozing position with no slide-slip or power loss in turning," states Operator Jack Campbell for Owner J. H. Marshall, Clovis, New Mexico. The Marshall TD-24 is shown dozing tough caliche rock for road surfacing.

cycle-speeding TD-24 your profit squeeze!

Flores and Perry, Laton, California, depend upon three International "75" Payscraper® units and a TD-24 Torque-Converter crawler—to fulfill their 8-mile grade-raising subcontract, on Central Valley Highway south of Hanford. TD-24 push helps boil-in 20 cu yd heap-loads, in only 42 seconds!

counts—watch how "dead-track drag" limits any king-sized steering-clutch crawler to what it can handle on turns. Then watch how years-proved Planet Power steering gives the TD-24 full-time, both-track power—to pull or push extra-big loads on the turns or straight ahead, uphill or down!

TD-24 control ease puts record daily production at your operator's fingertips. Cool and safe flush-deck design, control-tower vision, and reach-easy fingertip controls all increase operator comfort and performance. Never before has big crawler work-power been so load-responsive—or record work-production so easy to achieve!

Prove positively your profit-margin widens—with geared-and-steered-for-action TD-24 power giving you the success-margin of push or pull! See your International Construction Equipment Distributor for a TD-24 demonstration!

"The TD-24's 2-speed track steering holds you in 'dozing position with no slide-slip or power loss in turning," states Operator Jack Campbell for Owner J. H. Marshall, Clovis, New Mexico. The Marshall TD-24 is shown dozing tough caliche rock for road surfacing.

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A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Deceased

Continued from page 114

Carlos S. Kirkpatrick (M. '24), age 74, retired engineer for the Missouri Pacific Lines, died in Houston, Texas recently. Mr. Kirkpatrick was employed by the railroad for 40 years, and as chief engineer handled all maintenance and construction work. In addition, he had served as chief engineer for the International-Great Northern and Gulf Coast Lines.

Vernon R. Kneer (M. '44), age 55, died at Wautoma, Wis., recently. Shortly after graduation from the University of Wisconsin in 1925, Mr. Kneer entered the employ of Alvord, Burdick & Howson with whom he was continuously associated until his death, as principal construction engineer. He had been in charge of important construction projects in connection with water works at Louisville, Des Moines, Eau Claire, Dayton, and the 83 mile transmission line, pumping stations and intake development for the Saginaw-Midland water supply project. At the time of his death, he was engineer on construction of the Lake Michigan intake, 28-mile transmission line, and filtration plant project at Green Bay, Wis.

Nelson W. Magner (A.M. '30), age 58, chief of the Northern District, Municipal Division of the Panama Canal, Cristobal, died recently. Mr. Magner has been with the Municipal Engineering Division since 1929, serving as junior and assistant engineer, general foreman, supervisor and superintendent. Early in his career, he was resident engineer with R. W. Herbard & Co., Inc., in Panama.

Andrew Amos McCree (M. '26), age 73, president of McCree & Co., St. Paul, Minn., died recently. Mr. McCree, a graduate of the University of Minnesota, has been an engineering contractor in St. Paul for many years.

Masayuki Minamide (J.M. '53), age 26, engineer with the Inter-American Geodetic Survey, Fort Clayton, Canal Zone, died on May 30. After graduating from the University of Hawaii in 1953, Mr. Minamide served in the Sixth Armored Division of the U. S. Army.

Robert P. Parker (A.M. '15), age 88, retired engineer of Star City, Ark., died recently. Mr. Parker devoted much of his career to railroad work, and for a number of years prior to his retirement in 1945, was vice-president in charge of operation for the Arkansas Railway. Earlier he had been chief engineer for the San Antonio and Arkansas Pass Railway, and locating engineer with the Kansas City, Mexico & Orient Railroad.

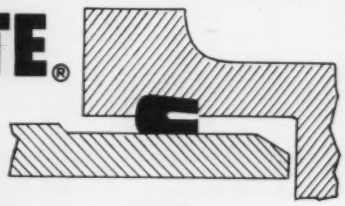
David H. Patton II (A.M. '32), age 56, retired Johns-Manville engineer of Chamblee, Ga., died recently. Mr. Patton's long career with the firm was highlighted by his appointment as district engineer, Power Production and Industrial Department, in 1947. Mr. Patton, a registered engineer and surveyor, began his professional work as a rodman and draftsman for W. H. Adey, and later served as construction and assistant engineer for a number of concerns.

William B. Petway (A.M. '53), age 42, retired Navy Lieutenant, Dade City, Fla., died recently. Mr. Petway first joined the Navy in 1942, and was assigned the supervision of advance base construction. In civilian life, he worked as draftsman-estimator and general superintendent of construction for the Paul Smith Construction Co., and as superintendent of maintenance construction for U. S. Phosphoric Products, both of Tampa. In 1951 he returned to service in the Civil Engineer Corps. He was educated at Vanderbilt University.

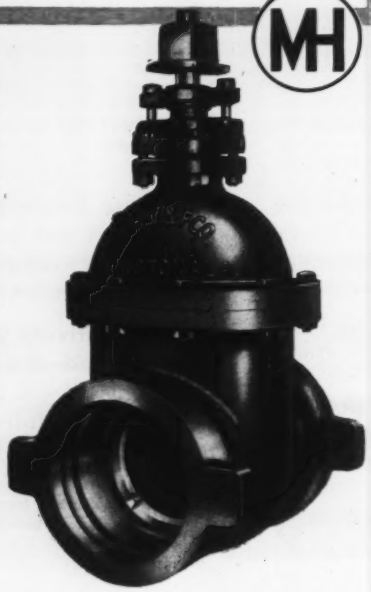
Jeremiah Daniels Richardson (A.M. '11), age 77, former railroad engineer of Corona, N. Y., died recently. Mr. Richardson spent most of his career with the Pennsylvania Railroad, with

Continued on page 120

FLUID-TITE® JOINT



VALVES & HYDRANTS FOR "CENTURY" ASBESTOS-CEMENT PIPE LINES



Specify FLUID-TITE* end-connections on M&H valves or hydrants ordered for installation with Class 150 "Century" asbestos-cement pipe. The hub ends of this valve or hydrant are especially designed to accommodate the FLUID-TITE gasket, and seal the joint when the end of a "Century" asbestos-cement pipe is inserted (see cross-section sketch of joint above).

No special fittings or extra joint materials are required. The only joint accessory is the gasket. Installation is simple and easy. Unskilled workmen can assemble the joint.

Either conventional or "O"-Ring stuffing box is available on M&H FLUID-TITE joint non-rising-stem gate valves. Wire or write for complete information.

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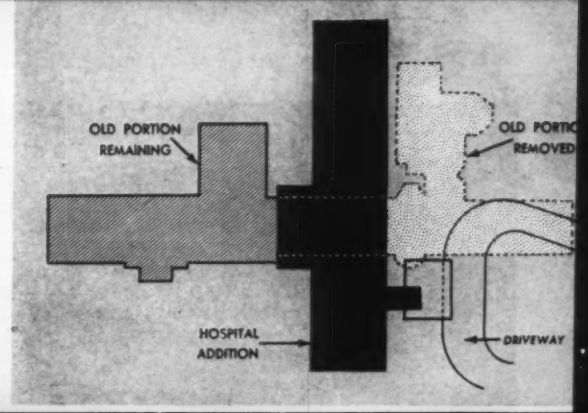

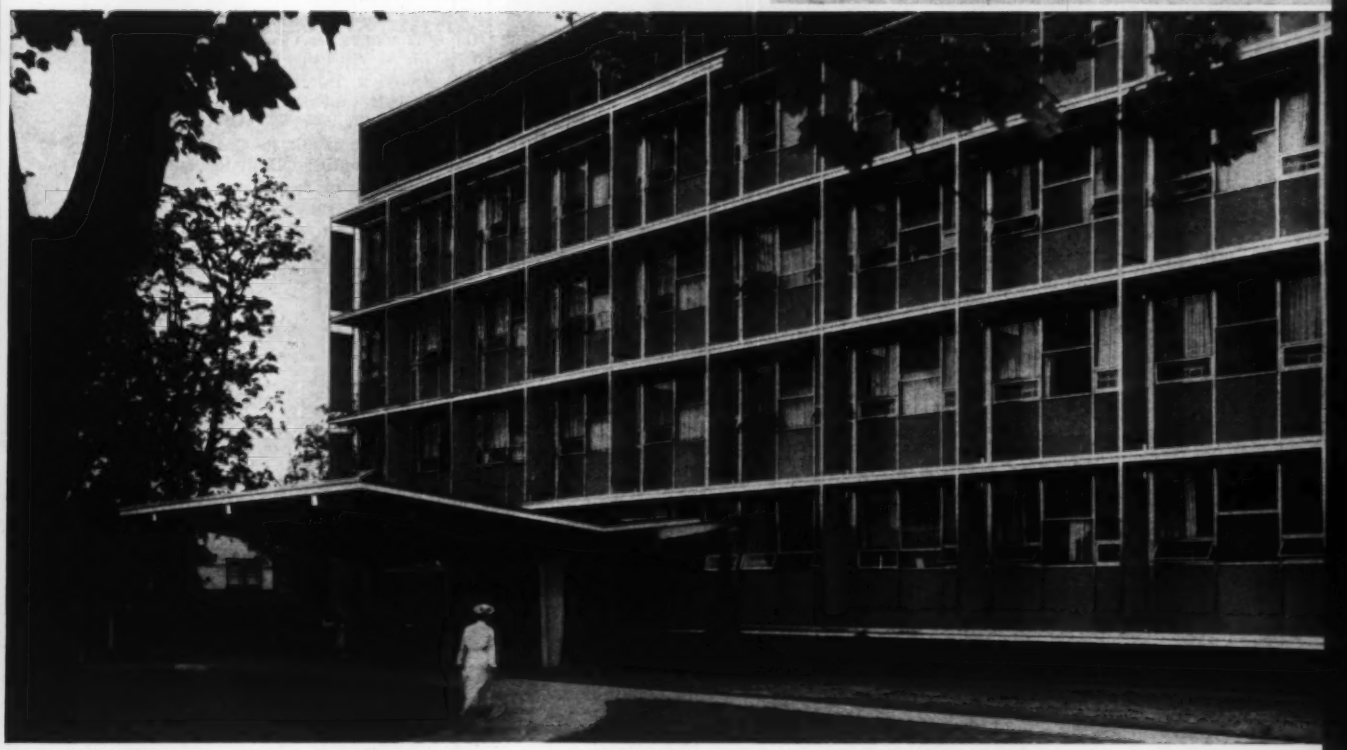

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1955 Bronze Medal, Philadelphia Chapter, AIA

"Here was an assignment that presented unusual problems at both the design and construction stages. Initially we had to design a new hospital wing to replace an obsolete building, and to connect with an existing wing to be retained. Then work had to be planned to cause the least possible noise, dirt and disturbance to normal hospital activity.

Our solution called for a steel-framed building intersecting the older units at right angles. The use of structural steel was an important factor in speeding the job and keeping dirt to a minimum. And work proceeded quietly, since we substituted bolting for riveting. Thus we met all the requirements, and produced a structure that has proven highly successful both functionally and aesthetically."

Structural Engineers:
Stevens & Bruder

General Contractor:
E. H. Keefer & Son

Steel Erector:
Mayer Pollock

Structural Shapes:
Bethlehem Steel Company

Vincent G. Kling, Architect AIA, Philadelphia, Pa.

A SIGNIFICANT NEW STRUCTURE . . . FRAMED WITH STEEL

This is the first in a series by Bethlehem Steel Company, Bethlehem, Pa.

Kaiser engineer sights through Berger 18" Dumpy Level under blistering desert sun on the site of Permanente's plant, designed to turn out 2,400,000 barrels of cement yearly.

Kaiser Engineers tell how

BERGER INSTRUMENTS beat desert sand and heat

Brutal climatic conditions were the order of the day, *every* day, during the construction of the huge Permanente Cement Company plant at Lucerne Valley, California. Yet, the job called for close tolerance measuring in layout of buildings and placement of machinery.

Berger levels were continually exposed to this blistering desert heat and clouds of destructive dust—conditions that would challenge the accuracy of ordinary instruments. But not Berger Instruments. Kaiser engineers put it succinctly: "They stayed in adjustment and performed perfectly, *without maintenance*, in these difficult situations."

Layouts for mill building, primary crusher, burner building and clinker cooler foundations were all done with Berger Instruments. Rough grade tolerances were held to .01 ft., base plates and equipment foundations to .007 ft. Two 12 ft. by 450 ft. rotary kilns, among the world's largest pieces of moving machinery, were installed with the aid of Berger Instruments.

Heat, sand, dust—not every job calls for such punishment. But isn't it good to know you have this extra safety factor, just in case?

That's why, where accuracy is at stake . . . any time . . . in any clime, leading engineers and construction men buy Berger. Put yourself behind a Berger—and see why.

C. L. Berger & Sons, Inc., 51 Williams St., Boston 19, Mass.

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BERGER

ENGINEERS' TRANSITS
BUILDERS' INSTRUMENTS
LEVELS
ALIDADES
THEODOLITES

Engineering and Surveying Instruments...Since 1871

Deceased

Continued from page 118

which he became connected shortly after his graduation from Rutgers College in 1902. He was with the Pennsylvania Tunnel and Terminal Co., North River Division, on the line's New York City terminal and tunnel project.

John J. Riedel (M. '13), age 84, retired chief engineer of the New York City Board of Estimate, died at his home in Brooklyn on July 1. Mr. Riedel was in the engineering service of New York City for 51 years—as chief engineer for the Brooklyn Bureau of Sewers from 1901 to 1934, and deputy chief engineer and chief engineer of the Board of Estimate from the latter year until his retirement in 1952. Had he been so minded he could have retired in 1927. His life-long specialties were the design and construction of sewers and the abatement of harbor pollution, and he held numerous awards for his writings in these fields. He was educated at the College of the City of New York and Cooper Union.

Viljo J. Rinne (M. '47), age 53, chief of the Canal Division, General Administration of Public Roads and Waterways, Helsinki, Finland, died recently. Mr. Rinne has served the General Administration of Public Roads since 1928 in the capacities of assistant engineer, canal engineer, chief of the Saimaa Canal, and chief of the office of the Canal Division. He was the author of a number of books on hydraulics and hydraulic engineering. He was graduated from Helsinki Institute of Technology.

William J. Schoneck (A.M. '34), age 64, lighthouse engineer of Key West, Fla., died recently. Mr. Schoneck, with the Superintendent of Lighthouses since 1922, had served as structural and architectural draftsman. He was educated at Pratt Institute.

Robert W. Stiles (A.M. '27), age 64, construction management engineer, U.S. Air Force at San Antonio, Texas, died on July 1. During his busy career, Mr. Stiles served as engineer for the U.S. Department of Commerce, assistant airways engineer for the Civil Aeronautics Administration, and resident engineer for J. W. Beretta Engineers Inc. and the Texas State Highway Department. Early in his career, he was secretary-treasurer of Beretta-Stiles Co., and an associate with Care, Piper & Stiles.

Walter Ward (M. '21), age 73, president of the Ward Engineering Co., and chief engineer for the Clear Water Lake Co., died at his home in Woodland, Calif. on July 5. As construction engineer for the U.S. Bureau of Recla-

Continued on page 122

American Industry rests on
RAYMOND FOUNDATIONS

take
TRANSPORTATION
for example

America is a study in motion. No other country in the world can begin to match our gigantic, never-ceasing flow of people, produce and products. It is a movement that fills the air and covers the ground and water. Improving and enlarging the transportation facilities for this constantly increasing number of men and material "on-the-go" has been another Raymond service for 60 years. Raymond foundations support structures at such busy airports as the Washington National Airport, New York's La Guardia Airport, the San Francisco International Airport and many others . . . in addition to thousands of miles of highways, bridges and overpasses; important rail terminals and docks and wharves along both coasts. In all, Raymond has completed over 132 foundation contracts for the transportation industry in the past year alone. If you have a foundation or heavy construction problem—whatever industry you're in—we'll be most happy to discuss it with you.

Administration building and C.A.A. Control Tower at Washington National Airport, Washington, D. C.

FOUNDATIONS FOR THE STRUCTURES OF AMERICA

COMPLETE CONSTRUCTION SERVICES ABROAD

RAYMOND
CONCRETE PILE CO.

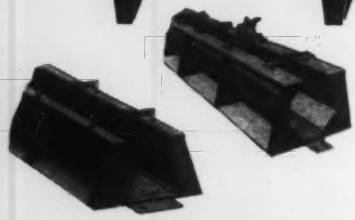
OUR 60th YEAR

You are cordially invited to send for our new Highway Brochure, which gives a detailed resume of how Raymond can help you and the National Highway Program. Just write Dept. C-9, Raymond Concrete Pile Co., 140 Cedar Street, New York, 6, N. Y.

FOR STANDARD OR CUSTOM PRESTRESSED FORMS—

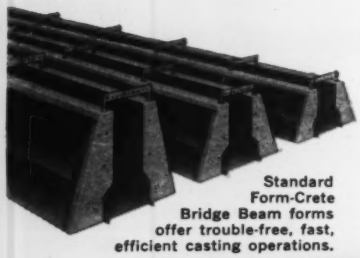
...look to the leader

FORM-CRETE

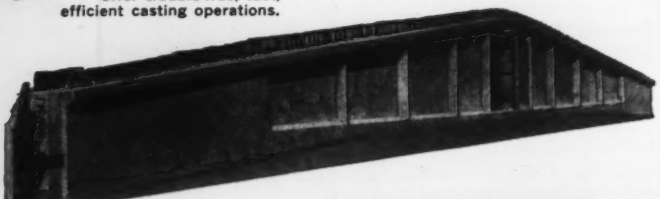


These versatile multi-purpose square forms and standard octagonal forms are available in two size classifications covering piling ranges of 12″ to 18″ and from 18″ to 24″

Whether your needs call for one of the many standard all steel forms or one of a special design, you'll find a ready answer when you call on Form-Crete. Stock or custom, Form-Crete steel forms are designed to produce the highest quality finished product, a product you can be proud to deliver to the job; and Form-Crete steel forms are versatile too. These multi-purpose forms offer maximum interchangeability throughout the entire size range of square piling and beam shapes. For custom forms, a special Form-Crete consultant service is ready and interested in applying a wealth of experience in designing the forms that meet your requirements. Call on Form-Crete, rely on Form-Crete for the finest in all steel forms delivered on time, when and where you want them.



Standard Form-Crete Bridge Beam forms offer trouble-free, fast, efficient casting operations.



A custom designed Form-Crete form was used to cast huge pre-stressed roof girders shown above for a large storage warehouse building.

Get into the profitable prestressed concrete business now with Form-Crete steel casting forms. Send for illustrated Bulletin 300.

fmc **FOOD MACHINERY AND CHEMICAL CORPORATION**
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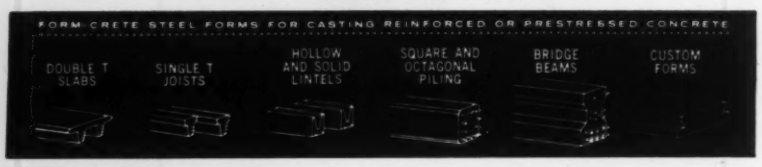


Deceased

Continued from page 120

mation for many years, Mr. Ward worked on dams and canal systems at the Boise Project, Idaho, Salt River Project, and the Arizona and Tieton Dams in Washington. Mr. Ward was graduated from the University of Kansas.

Carl L. Weir (M. '27), age 66, author, architect, and engineer, died recently. For many years an executive of the American Ice Company of New York City, Mr. Weir had charge of design, construction and contractual relations. He designed the water supply system for Langely Field, (Va.). Mr. Weir was co-author of *Sewage Disposal with Trickling Filters*, and wrote several articles on the problems of sewage disposal. He was educated at Cooper Union, the Beaux Arts Institute and New York University.

Mark Wilson Sr. (Aff. '42), age 71, prominent Chattanooga (Tenn.) building contractor, died recently. In 1912, Mr. Wilson founded a company bearing his own name, and was subsequently responsible for the erection of a number of important buildings in his city. Mr. Wilson was one of the founders and directors of the Dixie Highway Association, and a director of the Lee Highway Association.

Non-ASCE Meetings

American Institute of Steel Construction. Thirty-fifth Annual Meeting at the Hotel del Coronado, Coronado, Calif., October 7-10. Further information from AISC, 101 Park Avenue, New York 17, N. Y.

American Society of Mechanical Engineers. Fall Meeting at the Statler Hotel, Hartford, Conn., September 23-25. For information write to L. S. Dennegar, Director of Public Relations, the American Society of Mechanical Engineers, 29 West 39 Street, New York 18, N. Y.

American Society for Metals. 2nd World Metallurgical Congress in conjunction with the 39th Annual National Metal Exposition and Congress in Chicago, Ill., November 2-8. Inquiries may be

Continued on page 126

Someone is going to get taken for a ride

A Materials Interchange Plan can make it happen sooner—and make it a happy one . . . with 65 million cars on the highway—20 million more in 10 years—someone is getting taken for a ride . . . every minute of every day. Let's make it a happy ride. Current highway construction programs can do it. A *Materials Interchange* design and specification plan that includes Asphalt can help grandma get taken for a pleasant ride sooner.

Here's what at least one Midwest state is doing about it: Highway authorities have drawn plans for alternate types of construction. Materials available at the time of construction will be used. No time is lost in this construction program. No experienced engineering manpower is lost rewriting specs and redesigning projects.

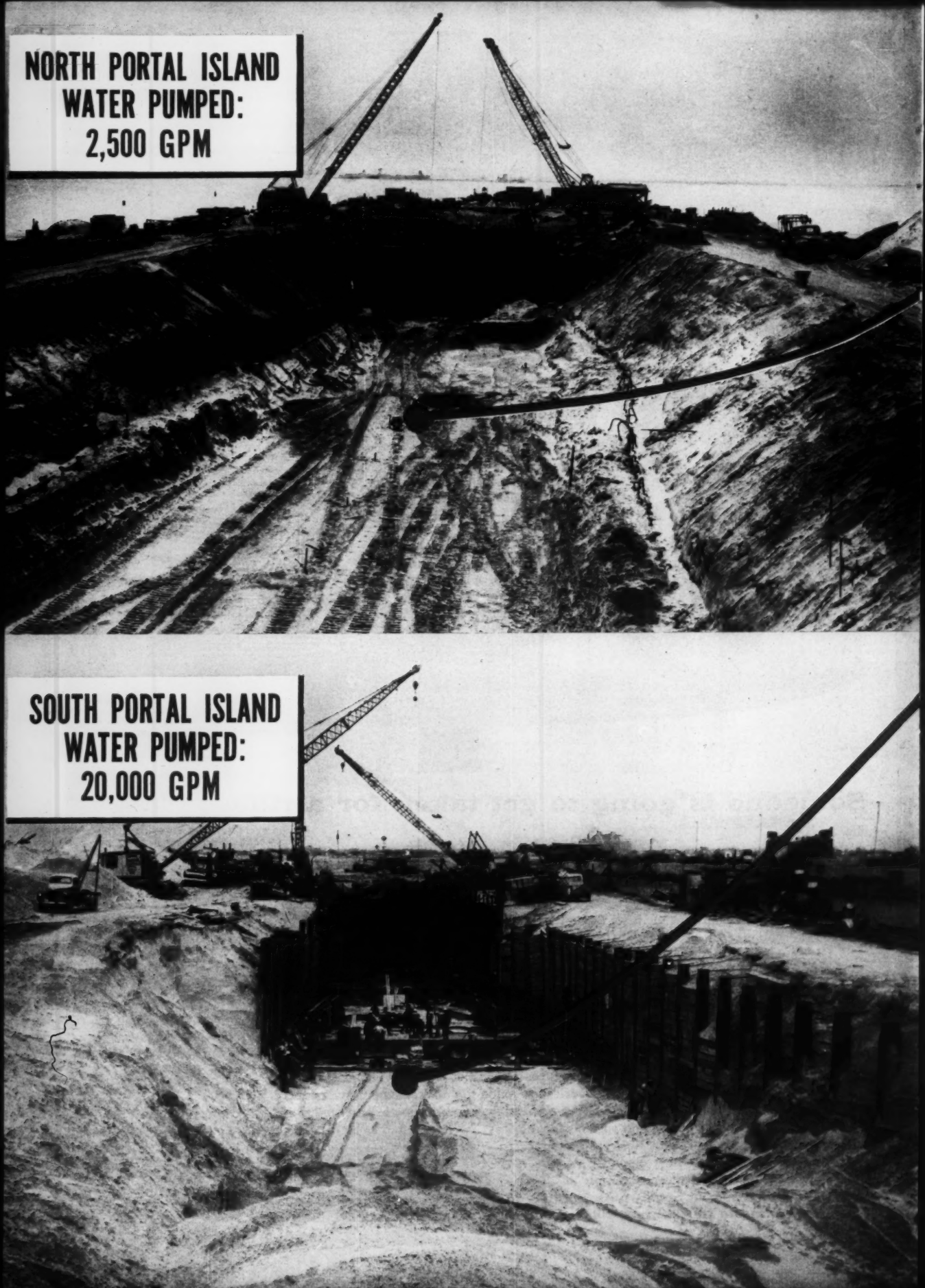
Make this your plan. Employ *Materials Interchangeability* so that roads under your authority may be built from materials available at time of construction. Include Asphalt in your construction planning.

Remember these facts: Standard Oil produces Asphalt at four convenient Midwest locations. Tank car and tank truck deliveries are made to you from the Standard Oil refinery nearest your job. Technical Service on Asphalt for highway construction is provided by Asphalt construction specialists who work out of 23 Standard Oil offices all over the 15 Midwest and Rocky Mountain states. Standard Oil has a record of taking care of its customers demonstrated by its delivery on contracts in times of short supply as well as when materials are plentiful.

Get more facts about STANDARD Asphalt from the Standard Oil office nearest you. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)


NORTH PORTAL ISLAND
WATER PUMPED:
2,500 GPM
SOUTH PORTAL ISLAND
WATER PUMPED:
20,000 GPM

Contractors For Portal Approaches: Tidewater Construction Corporation, Norfolk, Va.
Engineers: Parsons, Brinckerhoff, Hall & Macdonald, New York
Owners: Department of Highways, Commonwealth of Virginia

MORETRENCH WELLPOINTS

Make it Possible to Dig Deep and Dry in the Middle of Hampton Roads

On each of the man-made islands pictured here a deep excavation is being made in the dry for the north and south approaches to the vehicular tunnel which the state of Virginia is constructing under Hampton Roads, between Hampton and Norfolk. Bridges connect the islands to the mainland. The tunnel, running between the islands, will be one and one-half miles long.

Moretrench wellpoint systems keep 38' of water under control while excavation proceeds rapidly, economically, and safely.

You can count on Moretrench Wellpoint Equipment to insure progress on your wet job, regardless of size. Our nearest office will gladly estimate on your requirements. Sales, rentals, contracts. Catalog on request.

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Non-ASCE Meetings

Continued from page 122

addressed to W. H. Eisenman, 7301 Euclid Avenue, Cleveland 3, Ohio.

American Society of Photogrammetry. Meeting at the Chase Plaza Hotel, St. Louis, Mo., October 2-4. Details from C. E. Palmer, Secretary ASP, 1515 Massachusetts Avenue, N. W., Washington 5, D. C.

Building Research Institute. Plastic Study Group Meeting at Washington University, St. Louis, Mo., September 17 and 18. For information write to Charles R. Koehler, Building Research Institute, 2101 Constitution Avenue, Washington 25, D. C.

Bureau of Public Roads. Fourth Conference on Increasing Highway Engineering Productivity at the Somerset Hotel, Boston, Mass., September 17-19. For information write to H. A. Radzkowski, Bureau of Public Roads, Washington, D. C.

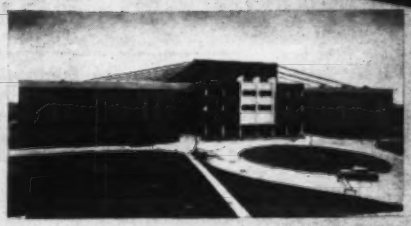
Council on Wave Research. Sixth Conference on Coastal Engineering at the College of Engineering, University of Florida, Gainesville, Fla., December 2-7. For information write the Council on Wave Research, Engineering Field Station, University of California, Richmond 4, Calif.

Engineers General Assembly. Conference of the Engineers Joint Council and the Engineers' Council for Professional Development at the Statler Hotel, New York, N. Y., October 24 and 25. Information from Dr. J. W. Barker, President, Engineers Joint Council, or from M. D. Hooven, President, Engineers' Council for Professional Development, both located at 29 West 39th Street, New York 18, N. Y.

Federation of Sewage and Industrial Wastes Associations. Thirtieth Annual Meeting at the Hotel Statler, Boston, Mass., October 7-10. For further information write to the Federation at 4435 Wisconsin Avenue, Washington 16, D. C.

National Society of Professional Engineers. Fall Meeting at the Grand Pacific Hotel, Bismarck, N. Dak., October 17-19. Details from Kenneth E. Trombley, NSPE, 2029 K Street, N. W., Washington 6, D. C.

Standards Engineers Society. Sixth Annual Meeting at the Hotel Commodore, New York City, September 23-25. Information from R. E. Mason, Room 2624, 70 East 45 Street, New York 17, N. Y.



Front view of hangar. Designed by Burns and McDonnell, Kansas City, Ammann and Whitney, Consulting Engineers, New York City. Contractors: MacDonald-Creighton, St. Louis and Nashville.

HUGE NEW HANGAR AT KANSAS CITY AIRPORT

OUTSTANDING EXAMPLE OF HIGH-STRENGTH CABLE SUSPENDED ROOF

High-strength cable suspension of roofs is more and more being used wherever great expanses of column-free space are required.

One of the most dramatic examples is the new TWA hangar at Kansas City's Mid-Continental International Airport.

The supporting cables—supplied by Roebling—are anchored in 30 ft. deep concrete walls which span between the building columns at 30 ft. intervals. Each roof is 150 ft. wide and 818 ft. long, plus a ten-foot door overhang along its entire length.

This new application is further proof that the economy of axially stressed members in general, and high-strength wire tension members in particular, is not only practical but the valid solution for structures such as truck and bus terminals, sports arenas and gymnasiums.

Roebling's Bridge Department Technical Service always is available for advice and creative design assistance on applications of wire members to physical structures. We invite inquiries about any project on which we might be of help. Write Bridge Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
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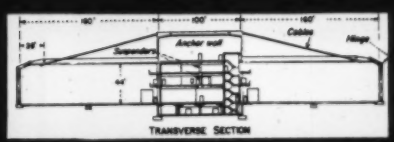
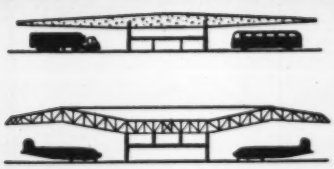


TRANSVERSE SECTION



Shown here are two examples of the versatility of the use of wire in structures. 1. A prestressed concrete bus/truck terminal. 2. The "gull-wing" type of suspended roof, employing a combined truss and cable system.

Four Roebling 2½" strands, each with a tensile strength of 752 kips, extend from anchor walls. Each wall is prestressed by two 2¼" post-tensioned bridge wire strands.

Positions Announced

Army Corps of Engineers. The Sacramento engineer district announces vacancies for Engineers, Engineering Aids, and Engineering Draftsmen in the Design Branch of the Engineering Division. There are openings for five Structural Engineers (GS-812-9) two for work on hydraulic structures, and two on buildings; two Hydraulic Engineers (GS-813-9) for work on design; four Civil Engineers (GS-810-11) two to work on soil mechanics, and one on specifications; three Structural Engineers (GS-812-11) one on hydraulic structures and two on buildings; one Sanitary Engineer (GS-819-11); and three Civil Engineers (GS-810-9). Interested persons should submit Standard Form 57 to Civilian Personnel Officer, P. O. Box 1739, 1209-8th Street, Sacramento, Calif.

Soil Conservation Service. The Soil Conservation Service announces an opening for a Civil Engineer (GS-7) to direct the operations of one or more survey parties in gathering basic engineering data relative to proposed or planned structures, systems and projects in Madison, Wis. The salary is $5,335 per annum. Applicants must have completed an accredited four-year engineering curriculum, and have one-half year of professional engineering experience. Apply to Charles H. Buell, State Administrative Officer, 3010 E. Washington Avenue, Madison 4, Wis.

Alaska Department of Health. There is an opening for regional Sanitary Engineers in Alaska at a salary range of $6,960 to $9,240 a year. For further information write to Amos J. Alter, Chief, Sec. of Sanitation & Engineering, Alaska Department of Health, Juneau, Alaska.

U. S. Civil Service Commission. The U. S. Civil Service Commission has revised and reissued its current examination for engineer. The positions to be filled are in various fields of work and pay from $4,480 to $11,610 a year. They are located in several Federal agencies in Washington, D. C., throughout the United States, and in foreign countries. For further information consult Civil Service examination announcement. No. 112 B. Information on examinations and application forms may be obtained from most post offices or from the U. S. Civil Service Commission, Washington 25, D. C.

San Diego County. There is one vacancy for Assistant Civil Engineer in the San Diego county surveyor's office. Applicants should be between the ages of 21 and 64 years, with at least two years of responsible professional civil engineering experience and the equivalent of a four-year college course with a major in civil engineering. For each year of college lacked, one year of responsible engineering experience may be substituted. A written examination and an appraisal of training, education and experience will be given equal consideration. Application forms are obtainable from the Department of Civil Service and Personnel, Room 402, Civil Center, San Diego 1, Calif.

University of Alaska. The University of Alaska announces an opening on the faculty of its civil engineering department. Applicants should be qualified in construction management, highways or structures. An opening also exists for a Sanitary Engineer in cooperation with a territorial agency. The positions may be filled at an academic rank corresponding to the experience and qualifications of applicants. For further information write to E. F. Rice, Department of Civil Engineering, University of Alaska, College, Alaska.

RECENT BOOKS

(Added to the Engineering Societies Library)

American Civil Engineering Practice
Volume 3

The third volume of this important new reference work edited by Robert W. Abbett, presents the fundamental principles, procedures, and data for the following section headings: theory of structures; masonry and plain concrete; reinforced concrete, including detailed design of members; prestressed-concrete structures; footings, piers, and abutments; retaining walls; steel and reinforced-concrete bridges; steel towers, tanks, bins, etc.; concrete chimneys, silos, tanks, etc.; timber structures; steel-framed and reinforced-concrete buildings, including structural planning; earthquake-resistant design. (John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1957. $25.00.)

Atomic Energy Applications With Reference to Underdeveloped Countries

The first part of this booklet by B. C. Netschert and S. H. Schurr reviews the uses of nuclear energy. Part II discusses the conditions necessary for using nuclear energy in terms of meeting requirements in cost and resources and in terms of conditions necessary to derive any

Continued on page 130

NEW! DISCOVERY!
SAVES PLUMBING BILLS
CLEANS INSTANTLY

CHICAGO — Sept. 1st — Factories, Machine Shops, Offices, Apartments including Home owners are constantly having trouble with clogged-up pipes which proves expensive in Costly Plumbing Bills —

But new — using Water Impact and Air Pressure, here is a new unit called the **Plumber's Flushing Gun,** which cleans all lines up to 100 ft. It will open any number of bends in pipe. Yet anyone can operate this new gun, which triggers easily.

TOILETS, URINALS, SINKS, and FLOOR DRAINS clogged with paper, grease, rags, sand, and other debris can be cleared with one or more shots from the gun, **saving the owner, the Gun's price the first time it is used.** This new Flushing Gun may be used on any ½ to 6 inch waste pipe including Sink Drains, Floor Drains, Hot Water Pipes, Drinking Fountains, Septic Tanks, and Urinals. Obstructions melt away INSTANTLY when struck by the hammer like blow of this new unit.

This new Plumber's Flushing Gun is offered on a 30 Day Free Trial to prove its value. **BUT MOST IMPORTANT IS THIS** — What is this Tool worth to your factory Machine Shop, Building, or in your own Home in **Costly Plumbing Bills Saved.** For your own good — Tear this Ad out, and write your name and address beside it for FREE BOOKLET right now — No agent will call — Obey that urge, mail now or write postcard. (Chicago Phone Kildare 5-1702) — **Miller Sewer Equipment, Dept. C.E., 4642 N. Central Ave., Chicago 30, Ill.**

YOURS FREE! CATALOG

Complete Literature on all of Miller Sewer Rod Equipment including Miller's Triple Action Grease and Root Cutter which features Patented self expanding Blades for 3 to 12 inch pipe, Hand and Electric Units, Flat Rods, Toilet Augers. Obey that urge and write to above address. Compare our Quality prices.

Ask For Catalog R

Electric Unit cleans up to 500 ft.

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of the
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....sets Transactions of 4th Congress	$30.00.....
....copies Report R-70 "Report on Frost Resistance of Concrete and on the Definition of Concrete Mixes"	$ 2.00.....
....Technical Dictionary on Dams (Second Edition)	$ 5.00.....
....copies Statistical Year-Book No. 8 on the World Power Conference	$10.00.....

The Secretary
U. S. Committee on Large Dams
29 West 39th Street, New York 18, N. Y.

Name.....

Address.....

City.....Zone.....State.....

New Minnesota Highway Department Building SUPPORTED BY ARMCO PILING

Construction is well underway on Minnesota's new $7,000,000 State Highway Department office. The building will consist of nine levels including a basement and sub-basement, with provision for two extra floors for future expansion. A two-story wing contains a materials and research laboratory and a basement garage.

More than 24,000 feet of Armco HEL-COR® Pile Shells were driven using the Cobi Pneumatic Mandrel System, for cast-in-place piling under the structure. A total of 1006 piles in 40- and 25-foot lengths were driven at the basement and sub-basement level, and filled with 4000 pound concrete without reinforcing. Design load was 50 tons a pile.

This foundation project is another example of Armco's supplying the right product to do a job. Armco Pipe Piles and HEL-COR Pile Shells are available in a wide range of diameters and wall thicknesses for foundations under bridges, buildings, and other structures.

Model of new Minnesota State Highway Department office building.

Armco Piling being driven by L. H. Bolduc Co., within sight of Minnesota's capitol in St. Paul.

A product to meet your needs

There are more than 30 Armco Drainage and Construction Products—used in highway, railway, industrial and commercial projects. All are economical and easy to install; all have demonstrated durability in service. Write us for details. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 5587 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO CONSTRUCTION PRODUCTS

HOW TO HANDLE
WET JOBS

IS THIS A RECORD FOR DEWATERING SILTY SAND & CLAY?

**Concrete box culvert, Old Bridge, N. J.
Contractor: Almeida Construction Co.**

PHOTO, JUNE 1—Griffin equipment shipped that day. Difficult swampy soil required use of specially designed sand filters around the wellpoints.

JUNE 4. Wellpoint system installed over weekend and excavation well under way. Actually, the 5 ft of water was under control just 20 *minutes* after pumping started.

That's how skillfully the filters were designed. P. S. Almeida called Griffin on the recommendation of a contractor friend. Ask *your* friends about Griffin.

GRIFFIN
WELLPOINT CORP.
881 East 141st Street, New York 54, N. Y.
Hammond, Ind. Houston, Tex. Jacksonville, Fla.
In Canada: Construction Equipment Co., Ltd.
Toronto Montreal Halifax

Recent Books

Continued from page 128

benefit from a particular use. The last part of the book describes the activities already undertaken to initiate nuclear energy programs in underdeveloped countries. (The Johns Hopkins Press, Homewood, Baltimore 18, Md., 1957. 129 pp., $2.00.)

Bandstrassen im Baubetrieb

Conveyer belt lines in the construction industry are treated in this practical textbook. Part I describes the equipment in detail and covers its selection and use, including supporting structures, drives, and auxiliary equipment. Part II deals with the cost aspects: dimensioning the plant, cost of equipment, cost of operation; and maintenance costs. The information given by author Heinrich Eckert is based on extensive practical experience. (Springer-Verlag, Berlin, Germany, 1957. 201 pp., DM 37.50.)

Brittle Behavior of Engineering Structures

Prompted by the failures in welded steel merchant ships in 1942-43, research in this field was instituted and widened to include all steel plate structures. This volume summarizes the available information, covering the following: fundamental properties and fracture theories; test methods and interpretation of results; influence of chemical composition and manufacturing practice; effects of welding composition variations; residual stresses; design aspects; and reports on individual service failures. This study, by Earl R. Parker was prepared for the Ship Structure Committee under the general direction of the Committee on Ship Steel of the National Research Council. (John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1957. 323 pp., $6.00.)

The Demand and Supply of Scientific Personnel

This important study offers evidence that, contrary to many previously published reports, there is no shortage of engineers in the United States. The study consists of five chapters dealing, respectively, with the growth of the technological professions; demand and supply; factors influencing the demand for engineers and chemists; the supply of engineers; and supply and demand for mathematicians and physicists. A considerable amount of statistical data is included in appendixes. Co-authors are David M. Blank and George J. Stigler. (National Bureau of Economic Research, 261 Madison Avenue, New York 16, N. Y., 1957. 200 pp., $4.00.)

Geologic Field Methods

For the inexperienced man in the field, this manual by Julian W. Low contains, in addition to the major outlines of geologic field work, hints and help on the minor aspects of methods and procedures which the author, from his long experience, has found most often needed in carrying out assignments. There is information on the organization of field work, field mapping, topography and areal geology, mineral exploration, subsurface methods and a section on living and working out of doors. (Harper & Brothers, 49 East 33rd Street, New York 16, N. Y., 1957. 489 pp., $6.00.)

Handbook of Rigging
Second Edition, 1957

This second edition of a complete manual of rigging practices by W. E. Rossnagel, serves as a ready reference and guide for expert riggers. New material includes a section on transportation since the rigger is responsible for loading trucks, and includes information on the "overland train" used in transporting loads over deserts and through swamps. There is a chapter on the actual hitching of slings to loads for hoisting and transporting and for turning suspended loads on their sides or tops as required. There are several chapters on the element of safety in rigging operations. (McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 342 pp., $6.50.)

Les Mecanismes Hydrauliques

A practical treatment of hydraulic power transmission devices by J. Faisandier. Chapter I covers general principles and the characteristics of the liquids used. The subsequent three chapters deal with the actual mechanisms: pump or other generator; receiving devices—jacks, hydraulic motors, servos; intermediate and auxiliary equipment—accumulators, distributors, valves, piping, etc. Specific applications to airplane and machine-tool operations are demonstrated. (Dunod, Paris, France, 1957. 210 pp., Fr. frcs. 2,200.)

Route-Mapping and Position-Locating in Unexplored Regions

Ground route-mapping as distinguished from that making full use of photogrammetry is the main subject of this book. The two principal parts of the book are given over to a method of route-mapping and to position-finding and altitude measurements. The third part takes account of photography as an aid in route-mapping and topographical surveys. Each part has its own author who is an expert in his field. By W. Filchner, E. Przybyllok and T. Hagen. (Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y., 1957. 288 pp., $9.00.)

Structural Planning and Design

Problems, with solutions, covering concrete slabs, footings, piles, and retaining walls; wood beams, columns, and joists; steel channels, columns, etc.; and many other subjects included in Part I of New York State examinations for professional engineer's license. (Available from the author, William Glendinning, 5123 Bell Blvd., Bayside, N. Y., 1957. 96 pp., $3.00.)

Urban Land Use and Planning

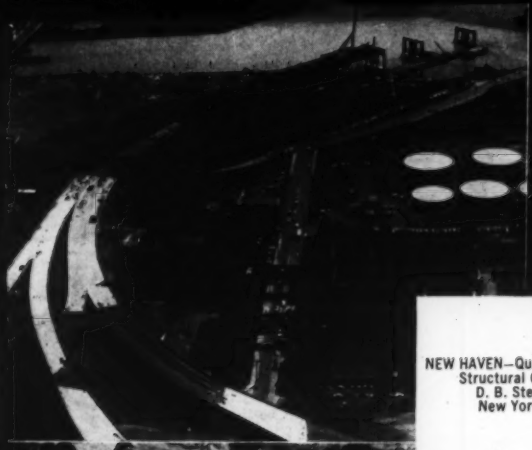
F. Stuart Chapin, Jr. presents a scholarly study of the theory and techniques for planning the renewal and development of cities with populations of from 100 to 500 thousand. Part I presents the theory, Part II and III the methods used in assessing the existing situation and formulating a plan for the rational location of industry, housing, recreational areas, etc., with proper regard for health, safety, convenience, and economy. (Harper & Brothers, 49 East 33rd Street, New York 16, N. Y., 1957. 397 pp., $8.00.)

Technical Descriptive Geometry
Second Edition, 1957

Written in simple language with many illustrations, this book by B. Leighton Wellman provides a comprehensive and modern treatment of the theory and practical applications of descriptive geometry for the student and industrial draftsman. Two new chapters on vector applications and geology and mining applications have been added. This edition also contains an improved presentation of visibility, perpendicular lines, views of a circle and cylinder intersections. (McGraw-Hill Book Company, 330 West 42nd Street, New York 36, N. Y. 628 pp., $5.75.)

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply photoprint or microfilm copies of any items in its collections. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.



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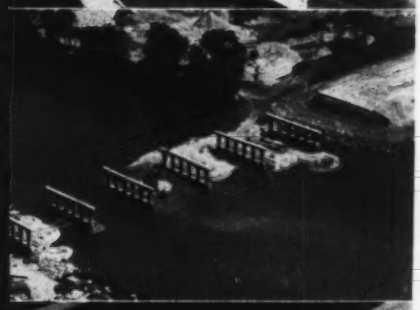

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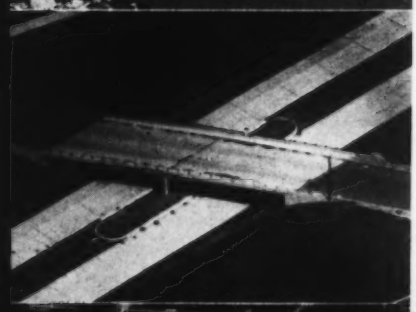

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Men Available

PROFESSOR OR INSTRUCTOR, M. ASCE; M.S. in Civil Engineering; 50; 20 years' professorship and 8 years' consulting engineering. Versed in the design of prestressed and reinforced concrete, and steel structures. Favorite courses offered are concrete, structures, mechanics, strength of materials, and railroad curves. No preference as to location. C-242.

HIGHWAY OR TRAFFIC ENGINEER, M. ASCE; B.C.E.; 72; land survey and city engineer 6 years; railway location and construction 2 years; drainage engineer 1 year, Philippines district engineer 5 years; railroad valuation engineer 1 year; district and division engineer and research engineer 35 years; senior traffic engineer for consulting, 37 years. Location desired: South or West. C-243.

CIVIL ENGINEER, J.M. ASCE; B.S.C.E.; 34; P.E., New York. Ten years' diversified civil and structural design as required by multi-plant manufacturer. Desires to increase scope of professional activity and will consider position affording improvement over present lack of advancement potential. C-246.

STRUCTURAL ENGINEER, J.M. ASCE; B.S.C.E.; 36; 5 years' general structural design experience in consultants office, including 1 year as head of structural department and 1 year as assistant bridge engineer. Licensed in Louisiana and Texas. Commercial pilot. Location desired: South. C-247-824-Chicago.

ENGINEERING ADMINISTRATOR, M. ASCE; member of American Management Association; 48; B.C.E.; registered New York, Michigan, and Rhode Island. Manager of plant engineering of multi-plant corporation for past 8 years, with heavy experience on new plant design and major alterations including construction; 25 years' experience on technical administration in staff capacity; seeks challenging position involving directing or coordinating engineering efforts with management programs. C-248.

Positions Available

ENGINEERS. (*a*) Highway Engineer, graduate civil, with considerable experience in the organization and administration of highway departments, that is, in the appraising of the economic and financial aspects of projects; some highway construction and maintenance experience desirable; preferably some experience in foreign countries. (*b*) Railroad Engineer, graduate civil or mechanical, with considerable experience in the operation and management of railroads, that is, in the appraising of the economic and financial aspects of projects; some railroad engineering and maintenance experience desirable; preferably some experience in foreign countries. Salaries open. Location: Washington, D. C. W-4711.

OFFICE ENGINEER, civil, mature, for an engineering and surveying practice. Must be able to organize work and trouble shoot difficulties in both field and office. Experience and ability are prime requisites. Location: western Pennsylvania. W-5055.

CIVIL ENGINEERS experienced in highway construction, especially soils and asphalt paving for large turnpike project. Salary open. Permanent position. Location: New England. W-5115.

MANUFACTURING MANAGER, 50-60, mechanical or civil engineering graduate, with at least 10 years' managerial experience covering engineering and production of heavy steel products associated with power plant and water works industry. Salary, $20,000-$25,000 a year. Location: Midwest. W-5128.

CIVIL ENGINEERS, graduates, with a minimum of 2 years' experience in highway or flood control work, or water drainage and sewage treatment background. Salaries open. Location: New England. W-5161.

CIVIL ENGINEERS. (*a*) Designer, graduate civil, to supervise the design of a project such as road or bridge work, or an industrial building. Experience in structural design and in highway layout and design; also experience in drafting specifications, preparing cost estimates, supervising design and preparation of plans and coordinating design phases of a project. Salary, $7,800-$9,000 a year. (*b*) Designers for bridge and building design work. Must be capable of designing and supervising the general project. Salary, $6,600-$7,800 a year. (*c*) Engineer, civil graduate, with railroad experience on terminal type facilities, for both field and office work on studies, reports and design of both railroad and industrial facilities. Salary, $6,600-$7,800 a year. All salaries plus fringe benefits. Location: deep South. W-5166.

CIVIL ENGINEER, Construction, graduate, 35-50, with a minimum of 10 years' experience in design and construction of buildings, bridges and structures; familiar with modern construction techniques and structural design utilizing all common construction materials such as concrete, steel, and timber. Some knowledge required of mechanical and electrical facilities normally associated with industries, commercial and public buildings. Will review designs, layouts, and specifications of structures for economy and feasibility of construction; check construction programs and contracts; assist in planning and scheduling construction, etc. Climate subtropical; living conditions good; family may accompany employee with travel expenses paid. Salary commensurate with past earnings and experience; transportation expenses and quarters allowance paid. Duration approximately 12 months with possibility of extension. Location: Far East. F-5168.

SANITARY ENGINEERS to act as technical advisers in the sanitary field for established representatives. Must be able to assist consulting engineers in waste treatment layouts and also have some selling ability—actual selling will be done by representatives. Starting salary, $7,000-$8,000 a year, plus expenses, plus an incentive. Will work out of New York or Philadelphia to handle Atlantic Seaboard from Richmond north to Boston. Company, with headquarters in the Midwest, handles centrifugal pumps, pneumatic sewage ejectors, compressors and waste treatment equipment. W-5197.

OFFICE ENGINEER, graduate civil, with 5 to 10 years' experience in heavy and highway construction; for medium sized contracting firm engaged in heavy and highway construction. About 80 percent to 90 percent of time will be spent in main office; remainder will be spent at project office in the field. Permanent; excellent opportunity. Salary open. Location: Midwest. W-5203.

Continued on page 134

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Men and Jobs Available

Continued from page 132

City Planner, preferably graduate civil, 25-35, with at least 3 years' in city planning, public administration, economics, political sciences or related fields. Will assume responsibility for preparation of comprehensive city plans. Salary open. Location: northwestern Pennsylvania. W-5210.

Hydraulic Engineer, experience in sewer and water works, sewage treatment and water treatment; should be competent to design plants and inspect same during construction. Will make spot inspections and supervise resident engineer. Salary open. Location: New York State. W-5216.

Sales Engineer, with sales ability, experienced in concrete or concrete construction to head up new district sales office. Long-term, interesting, independent and challenging position. Salary to start, about $7,200 a year, expenses and commission. Territory: Atlanta, Ga. Headquarters: New Jersey. W-5242.

Instructor to teach general civil engineering courses, with emphasis on highways, construction management, or structures. Teaching experience desirable but not essential for a qualified man. Rank open depending upon qualifications; salary to $7,000 for 8 months with opportunity for summer employment. Location: Northwest. W-5249.

Civil Project Engineer, with 10 years' experience in the design of water supply, sewerage, roads, flood control; to represent American firm in Iran. Several years work. Salary open. F-5263.

Structural Designer, Draftsman and Specification Writer, experienced in building design for an architect's office. Location: Connecticut. W-5267.

Assistant or Associate Professor with at least M.S. in civil engineering, to teach: (*a*) Fluid Mechanics; (*b*) Sanitary Engineering. Salary, $6,000-$7,000. Location: New Jersey. W-5284.

Chief Engineer, preferably civil, for fruit handling organization, to coordinate tropical and domestic operations. Considerable construction including housing, roads, communications, sewage, etc. Some travel, to tropics. Salary, $12,000-$15,000 a year to start, plus profit sharing. Company will negotiate placement fees. Headquarters: southern United States. W-5292(*a*).

Structural Engineer, civil graduate, preferably with highway bridge experience. Location: Arizona. W-5293CS.

Manager of Village Office, civil or sanitary engineering graduate, 35 to 40; 5 or more years in general municipal engineering field and office, with a knowledge of building codes. Will supervise all engineering and administrative work, under the direction of board of trustees, for municipality of about 14,000. Village has own water works and sewage disposal plant. Department has about 40 employees. Salary, to $10,000 a year. Employer will pay the placement fee. Location: N.W. of Chicago. C-6391.

Instructors, Assistant Professor; to teach (*a*) Civil Engineering, prefer M.S. with practical and/or teaching experience and qualified in field of highways, to teach highways and surveying; (*b*) Electrical Engineer, preferably specialized in field of electronics. Salary, $5,500-$8,000 for 9 months depending on education and experience. Location: West. S-3036.

Applications for Admission to ASCE, June 30-Aug. 3

Applying For Member

William Anthony Back, New York, N. Y.
Floyd Albert Bishop, Lander, Wyo.
Virgil Blancato, Brooklyn, N. Y.
Boris Sergeevich Browzin, Chicago, Ill.
Robert Edward Lee Counts, Falls Church, Va.
James Lee Darnell, Jr., Washington, D. C.
Hoy D. Davis, Jr., Washington, D. C.

Continued on page 136

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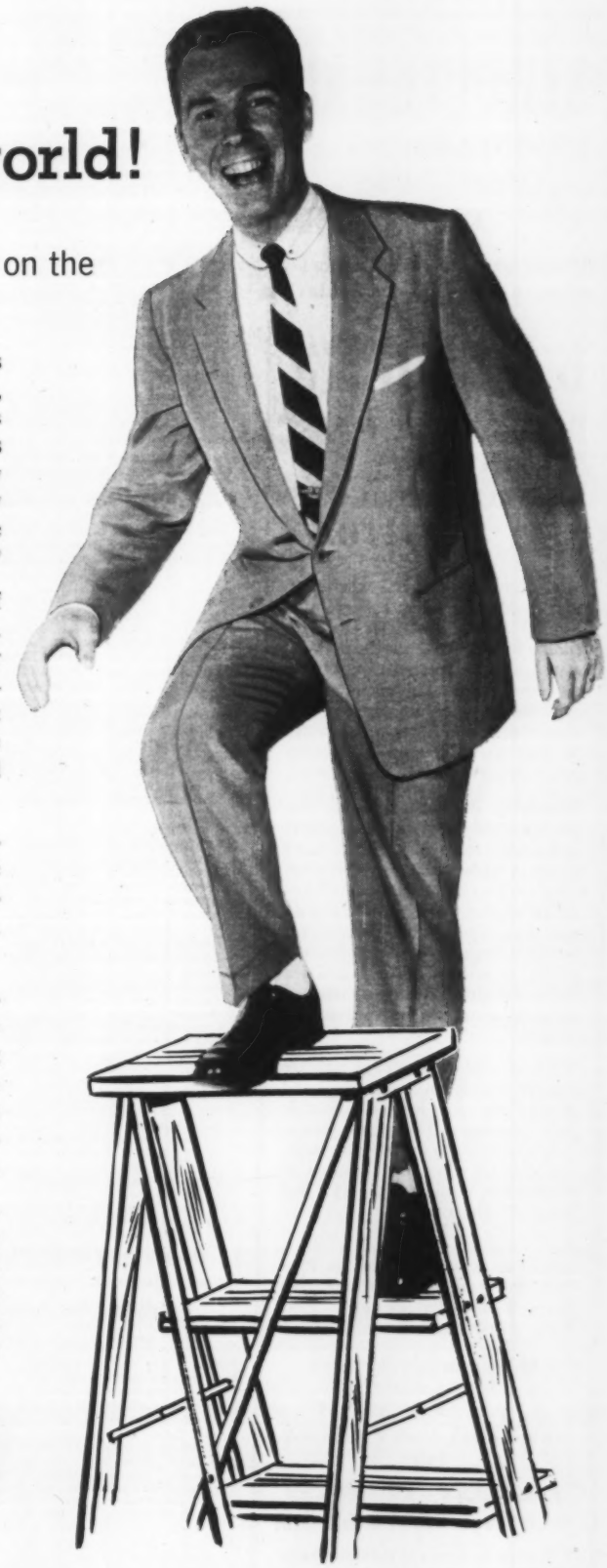

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Applications for Admission to ASCE June 30-Aug. 3

Continued from page 134.

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MORRIS NATHAN FIALKOW, Jericho, N. Y.
HENRY ISAAC FITZ, Denver, Colo.
DONALD CAMERON GRANT, Compton, Calif.
VICTOR EINAR HANSEN, Boise, Idaho.
ROBERT COOPER HAVEN, JR., Chicago, Ill.
WILLIAM MERRILL HENDRICKSON, San Francisco, Calif.
ANDRE LECLERC, Montreal, Canada.
WILLIAM HORACE LEWIS, New Orleans, La.
CHARLES STUART MACVEIGH, Fort Belvoir, Va.
DANIEL POLK MORSE, Indianapolis, Ind.
ROBERT TILMAN NELSON, Chicago, Ill.
JOHN DONALD PETERS, Inglewood, Calif.
CHARLES DEAN RAMSDEN, Alameda, Calif.
JACOB FRANCIS REDLINGER, Kansas City, Kans.
THEODORE MCBRIDE REYNOLDS, Schenectady, N. Y.
LUDWIG KRISTAP ROZENTALS, Grand Rapids, Mich.
JOSEPH HENRY SCHOTLAND, Newark, N. J.
GEORGE PHILIP SCHRADER, JR., South Charleston, W. Va.
JOHN MILTON SHIELDS, Rolla, Mo.
CLEEIN RODNEY SMITH, Washington, D. C.
JOHN GRIMES WALKER THOMAS, Lowell, Mass.
THOMAS HAROLD TOWNSEND, Napa, Calif.
ALFRED WILLIAM WEST, Los Angeles, Calif.
WILLIAM EUGENE WOOD, Cincinnati, Ohio.

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GEORGE BERNHARTH, New York, N. Y.
CLYDE ALAN BLODGETT, Los Angeles, Calif.
JAMES HOWARD BROWN, Whittier, Calif.
JOHN-MAGNUS BRUUN-HANSSEN, Brooklyn, N. Y.
LOUIS ALEXANDER COHEN, Poughkeepsie, N. Y.
ROY ERIC COXON, Montreal, Que., Canada.
ADOLPH EDWARD DEMBITZ, New York, N. Y.
MOHAMMAD SALEM FAYYAD, London, England.
GENE ROBERT FIALA, Portland, Oreg.
AKIRA FUJIMOTO, Hilo, Hawaii.
RAYMOND OTTO HALVORSON, Chehalis, Wash.
MIAN MOHAMMAD HANIF, West Pakistan.
LAURENCE GRAHAM HOLT, Woodbury, N. J.
WALTER EPLER HOOVER, JR., Malvern, Pa.
DONALD HOLYOKE KETCHUM, Utica, N. Y.
DAVID KWOK LIENG KWONG, Montreal, P. Q., Canada.
MAURICE ARTHUR THOMAS LEE, Colombo, Ceylon.
ALGERNON CHARLES LIEBENBERG, Cape Town, South Africa.
LEONARD OTTA LONG, Alameda, Calif.
HUGH MCGILVRAY, Corpus Christi, Tex.
WILLIAM PATRICK MCHUGH, New York, N. Y.
HOWARD WALTER MEIER, Tampa, Fla.
CHARLES HENRY MEYERS, JR., Cleveland, Ohio.
JAMES WILSON MURRAY, Sussex, England.
SAUL NAMYET, Cambridge, Mass.
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FERNANDO OLIVEROS RIVES, Madrid, Spain.
BERTEL ORLANDO OLSON, Corvallis, Oreg.
SAMUEL PACTER, Pasadena, Calif.
ARNOLD OBYCE PALMORE, JR., El Paso, Tex.
WARREN HASKELL PETTINGELL, Madrid, N. Y.
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MAHMOOD POOZESHI, Tehran, Iran.
ARTHUR HERBERT RITZ, Syosset, N. Y.
ROBERT EDWIN SCHLOEMER, Milwaukee, Wis.
NITAI PADA SEN, Rangoon, Burma.
RALPH HALMER SHANKLAND, Los Angeles, Calif.
FRED MICHAEL SMITH, Pittsburgh, Pa.
WARREN GEORGE STEINKELLNER, Brookfield, Wis.
ROBERT WETZEL THREET, Little Rock, Ark.
WILLIAM CLYDE WARD, Atlanta, Ga.
CHARLES NORMAN WESTERGREEN, Pittsburgh, Pa.
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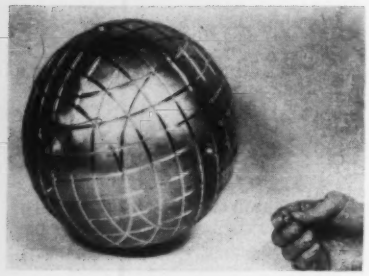
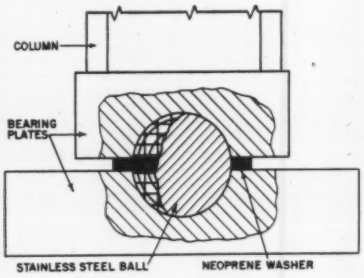
Steel Balls Simplify Bridge Support

STAINLESS STEEL BALLS, at the top and bottom of columns supporting bridges, permit full movement of the structure. The columns move without restriction so that they carry vertical loads only. Horizontal forces are taken care of at the abutments. A horizontal truss under the floor beams of the bridge provides lateral stability and eliminates the need for skew structure and can be quite small as they do not resist horizontal forces.

The balls illustrated are hot-forged Type 410 stainless steel, heat treated to a Brinell hardness of about 240 and grooved in three directions to hold graphite paste lubricant. Two bearing plates are of structural steel of 140 to 150 Brinell hardness, with hemispherical





bracing between columns. Unlike columns supported on pins or flat bearing areas, the ball-joint columns provide freedom of movement without subjecting the columns to high bending stresses.

These simple columns can be located so that floor beams are square with the bridge rather than on a diagonal as is necessary with conventional design of a

sockets machined to a radius 0.01-in. larger than that of the ball. A Neoprene washer is provided around the ball and is held in compression between the two bearing plates to exclude foreign matter and retain the graphite lubricant throughout the life of the bridge. **Industrial Tectonics, Inc., CE 9, Ann Arbor, Michigan.**

Steel Shoring

PREFABRICATED STEEL SHORING IS helping to reduce forming costs in the construction of concrete overpasses, underpasses, bridges, bridge piers, tunnels and elevated structures. This shoring is made from 2-ft to 5-ft wide welded steel end frames varying in height from 3-ft to 6-ft 6-in., base plates, U-heads, 20-in. adjustable legs and diagonal braces to provide spacing from 2-ft 6-in. to 7-ft apart. Comprising one section, these units are placed atop one another to make towers reaching nearly any height desired. The towers are then placed in rows to support the load. By reducing the distance between rows the load can be increased. Simple to erect, the steel shoring sections are assembled quickly under job conditions. They are free standing and suited to the easy placement of forming lumber. Since the steel shoring supports all of the load, the forming lumber can be substantially reduced in size, eliminating the need for cranes to transport and place it. The 20-in. legs adjust quickly to the exact shoring height desired, automatically provide scaffolding for the stripping of forms and eliminate cutting, fitting and wedging with wood. Steel shoring is completely recoverable and can be reused many times on totally different work. **The Patent Scaffolding Co., Inc., CE 9, Long Island City 1, N. Y.**

Masonry Saw

A NEW MASONRY SAW THAT cuts wet or dry has many features to increase operator efficiency: complete front-end control of all machine functions and adjustments; the ability to balance motor and arbor weight on the rear connecting bar during changes, thus relieving strain; a new handle on the front of the arbor whereby it may be raised or lowered to any column slot. A new front lever control releases the connection between the arbor and the wide foot pedal. When the correct angle is reached, a spring loaded pin re-engages the connecting bar. The arbor may be rigidly locked against vertical travel when the diamond blade is cutting. A blade depth control stops the blade at any desired depth of cut, while a timing belt eliminates belt slippage. The saw accommodates either 14-in. or 18-in. blades. Motors are 1½ or 2-hp and operate on either 110 or 220-v ac by flipping the starting switch. A safety feature eliminates use of the wrong source. Motor and spindle pulleys are reversible. The saw can also be used with abrasive wheels with the same efficiency. **Felker Mfg. Co., CE 9, 1128 Border Ave., Torrance, Calif.**

Built-in Color

A NEW 2-PACKAGE combination of products, for economically obtaining built-in color for concrete floor areas such as patios, garages, breeze-ways, etc. is now available in 10 colors. One package contains 35-lb of Colorcron, a premixed, ready-to-use material which when applied to freshly placed concrete produces a uniformly-colored, wear-resistant surface. The other package is a 1-lb can of Colorwax, a 2-purpose wax that cures new colored concrete floors and waxes the floor to enhance and protect the finish. This size-combination is sufficient for approximately 70-sq ft of floor. For larger areas Colorcron is available in 100-lb bags; Colorwax in 5-gal containers. **Master Builders Co., CE 9, 7016 Euclid Ave., Cleveland 3, Ohio.**

Light Dumpy Level

A LOW-COST PRECISION instrument, the new Light Dumpy Level is expected to find wide use by engineers in the construction of foundations or abutments, in grading streets or highways, in setting steel for buildings and roads, in hydraulic or drainage projects or in setting machinery.

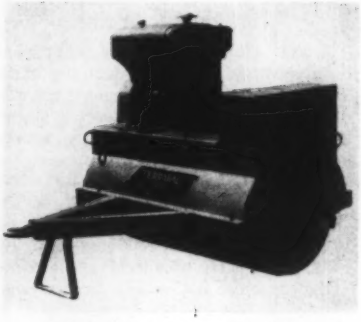
Two Models Available

The telescope measures 13-in. and features brilliant illumination, hard-coated lenses and a covered glass reticle with cross lines. Minimum focus is 6½-ft. The spirit level features protective mounting, "standout" bubble and sensitive uniform movement. One model, No. 380, is without horizontal circle. The other, No. 380-A, has a circle for reading horizontal angles to 5-min.

Made largely of high-strength aluminum alloys, the Light Dumpy is finished in smooth gray hammertone. The carrying case is mahogany or other hard wood. Protective packing blocks preserve adjustment. **W. & L. E. Gurley, CE 9, Station Plaza, Troy, N. Y.**

Vibratory Compactor

THE NEW LOW-COST Terrapac Model CK 10 vibratory soil compactor weighs only 1½-tons yet produces a 5-ton impact due to a unique combination of vibratory frequency—2400-vpm—and high amplitude—0.047-in. Lower vibration frequencies mean less wear and tear on the unit, sharply reducing maintenance problems. Downtime is virtually eliminated. This compactor's heavy-duty, dustproof bearings insure against maintenance problems arising in the field. Special shock absorbers isolate the drum from the frame so that no destructive vibration is transmitted to the gasoline engine or battery.



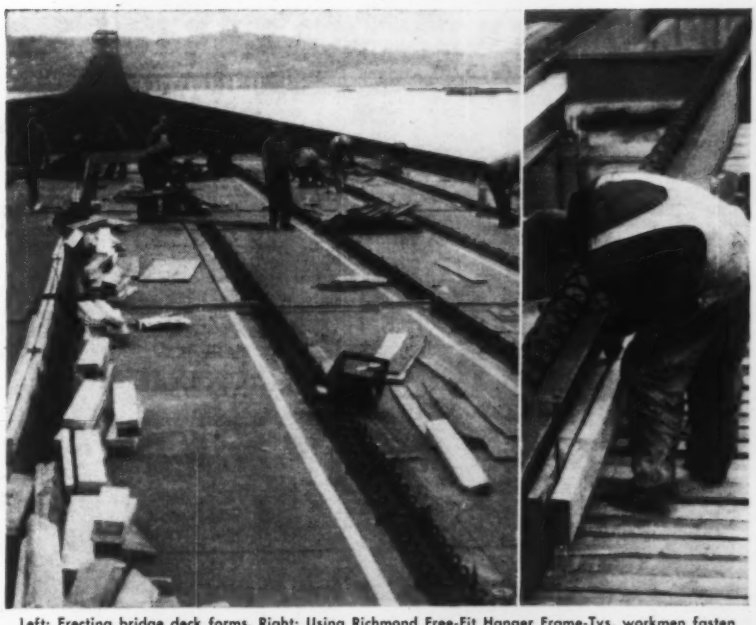
Terrapac Model CK 10

The CK 10 is 88-in. long and 61⅝-in. wide. The drum has a width of 55-in., while its diameter is 29½-in. Turning radius is 12-ft.

Highly maneuverable, the CK 10 may be towed by the smallest rubber-tired tractor to within 1½-in. of walls, abutments, etc. The twin scraper bar keeps the drum clean when rolling forward or backward. **Vibro-Plus Products, Inc., CE 9, P. O. Box T-368, Stanhope, N. J.**

Four-Wheel Tractor

THE NEW MODEL 840 4-wheel tractor resembles the 850 tractor but has the 4-speed transmission as standard equipment. The over-and-under transmission provides 2 additional speed ranges for each gear ratio of the 4-speed transmission. Thus, with a four speed transmission, the user has a choice of 12 different forward gear speeds, including a top speed in excess of 20 mph. This permits him to apply the correct amount of power to the job he is doing. The large 172-cu in. piston displacement engine is also standard equipment on the tractor, which is suited for both farm and industrial use. **Ford Motor Co., CE 9, Tractor & Implement Div., Birmingham, Mich.**



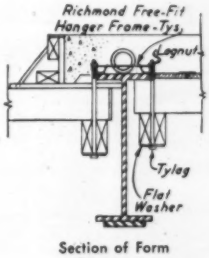
Left: Erecting bridge deck forms. Right: Using Richmond Free-Fit Hanger Frame-Tys, workmen fasten walers from above. Contractors: Garofano — West-Shore — Euclid. Engineers: Madigan-Hyland.

"Fast forming method & Richmond Hanger Frame-Tys speeded up Tappan Zee deck paving"

Charles Spero

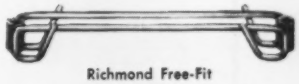
The 6-lane deck of the New York State Thruway Authority's 3-mile long Tappan Zee Bridge took 33,000 yards of concrete and considerable ingenuity. A combination of stock-size plywood sheets, filler strips of wood and metal, and Richmond Free-Fit Hanger Frame-Tys helped get the bridge open early.

Euclid's construction boss, Charles Spero, says they saved lots of time and money by hanging the forms with Richmond Free-Fit Hanger Frame-Tys —45,430 of them. Since the Richmond Tylag passes through an over-size coil and is adjusted by a nut on the upper end, the forms can be handled from above. "These Richmond Hangers speed up the whole operation," Mr. Spero points out. "You don't have to build a lot of scaffolding, work under the deck and risk accidents. The forms are quickly assembled, and easy to take out, too. And there's hardly any repair work to be done.



Section of Form Construction

"What's more, they're more economical when you figure the cost per foot," says this veteran Euclid superintendent. "A lot of fellows who use wires forget to figure the hidden costs —they don't stop to think about the labor putting in the wires and, later, the patching. With wages going up all the time, those savings keep getting bigger."



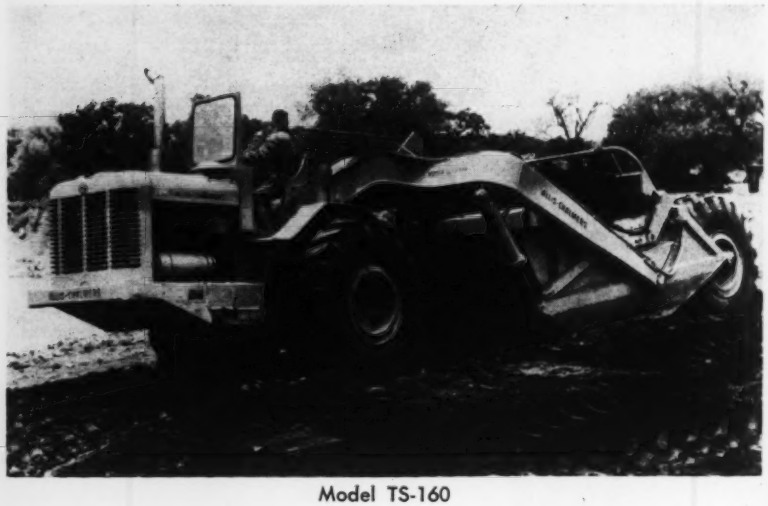
Richmond Free-Fit Hanger Frame-Ty

Richmond also makes a standard type Hanger Frame-Ty with two helix coils. For use where a slab is haunched to meet the top flange of the steel beam, Richmond makes Offset Hanger Frame-Tys with coils high enough above the top of the beam to permit the metal to be properly set back from the concrete. Richmond Fascia Hanger Frame-Tys combine hanger and fascia-tys for use on outside girders of bridge decks.

All these—along with the complete line of Richmond engineered tying devices, anchorages and accessories—are described in the new Richmond Handbook. To get your copy—or help on a specific concreting problem — write to RICHMOND SCREW ANCHOR COMPANY, INC., 816 Liberty Ave., Brooklyn 8, N. Y. or 315 So. Fourth Street, St. Joseph, Mo.

(continued)

Motor Scraper



Model TS-160

THE NEW HYDRAULIC 7-cu yd struck, 9.5-cu yd heaped, 12-ton payload, Model TS-160 features a supercharged Diesel engine rated 155-hp at 2200-rpm, and 516-cu in displacement. A one-piece all-steel tractor frame gives rigid support for engine, clutch and transmission, and provides easy accessibility without disturbing adjacent parts. Final-drive housing is an all-steel, precision-welded structure that is stress-relieved and line-bored for true alignment of all gears, shafts and bearings. The 5-speed constant-mesh transmission fully utilizes the high torque output from the engine. Forward speeds range from 3.1 to 25.4-mph, and reverse at 3.1 mph.

The TS-160 carries 66% of its weight on the drive wheels when empty and has equal weight distribution on all 4 wheels when loaded, assuring better traction flotation and stability. Two-speed hydraulic steering with 90-deg steer each way enables it to swing into a right-angle turn with only a ⅛ turn of the steering wheel. A complete non-stop turn is made in 24-ft 8½-in. The wheel also regulates the pump flow to the steering jacks. A relief valve in the steering system protects the hydraulic system from excessive shock loads if one of the tractor wheels hits an obstruction. Full-flow filtering insures clean hydraulics and efficient operation of the controls, all of which, including those of the hydraulic scraper are within easy reach of the operator. One lever raises and lowers the bowl; another provides instant and positive control of the apron and ejector.

The low, wide-bowl design features a curved one-piece steel bowl bottom. This curvature lessens loading resistance and creates a live material action that results in heaped loads fast. Apron opening of the bowl is 83½-in. and width of cut is 97½-in. The depth of cut ranges from 0 to 24¾-in. and the depth of spread is 0 to 16⅝-in. The bowl sides are 44-in. high. Two powerful double-acting bowl lift jacks exert down pressure at the cutting edge for rapid action in the penetration of the hardest materials and in lifting the bowl out of the ground. The 3-piece cutting edges are interchangeable and reversible. **Allis-Chalmers Mfg. Co., CE 9, Milwaukee 1, Wis.**

Planimeter

A NEW-TYPE PLANIMETER OF the optical compensating type has been specially designed for speed and convenience on measurement problems: at the touch of a button, it flicks to zero. Other features of this high precision instrument include an optical tracing lens instead of a point, and a dust-tight carriage. **Fennel Instrument Corp., CE 9, 45-22 Pearson St., Long Island City 1, N. Y.**

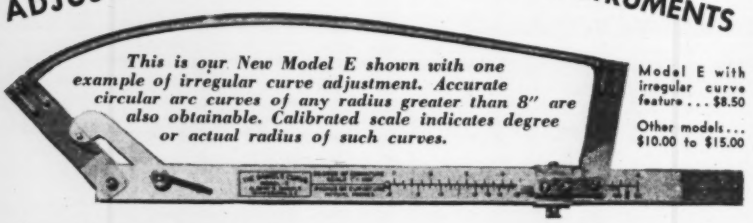
Turbodiesel Engine

A NEW 450-HP TURBODIESEL engine has been produced for use in pumping units, locomotives, marine equipment, oil well drilling rigs, shovels, and electric power generation. It utilizes normally wasted energy of exhaust gases, by means of a turbocharger, to develop additional horsepower. A turbine, located in the exhaust system, drives a centrifugal blower in the air intake system. By forcing a greater weight of air into the cylinders, more fuel can be burned completely and more power developed. A 6-cylinder engine, it has a rating of 450-hp at 1100-rpm and displacement of 2477-cu in. The LRT-6 (industrial) is 99⁵⁄₁₆-in. long, 39⁵⁄₁₆-in. wide and 58¾-in. high. The LRT-6 (power unit) is 136¹⁄₁₆-in. long, 53⅝-in. wide and 86⅛-in. high. Their weights are 7690-lb and 12,100-lb respectively. **Cummins Engine Co., Inc., CE 9, 5th & Union Sts., Columbus, Ind.**

Aluminum Bridge

FEW BRIDGE STRUCTURES have as high a ratio of aluminum to steel as the new Walt Whitman Bridge, now linking Pennsylvania with New Jersey. Aluminum was specified for the overhead, 6-lane traffic light arches and walkways, plus over 9,000-ft of hand railing. All arches, walkways and the hand railing were custom-fabricated. Engineers point out that the use of aluminum not only cut hundreds of tons of dead weight from the bridge, thereby cutting other supporting weights, but more important savings were gained in labor and construction costs. Also, the aluminum remains maintenance-free after construction, due to its resistance to corrosion. **Washington Aluminum Co., CE 9, Penn RR & Knecht Ave., Baltimore 29, Md.**

ADJUSTABLE CURVE DRAFTING INSTRUMENTS



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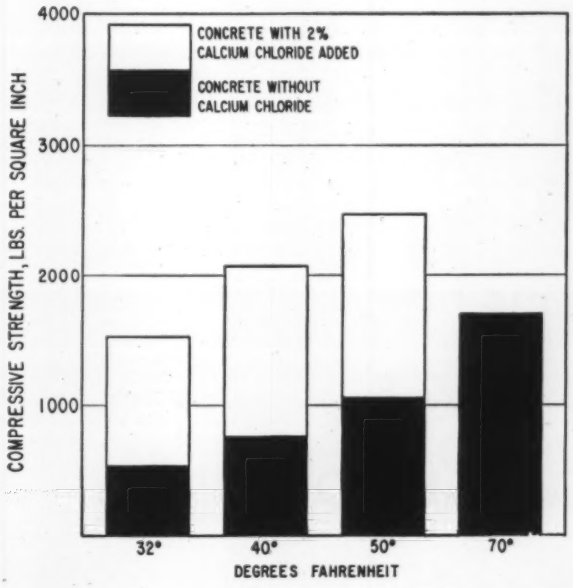

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Jack Ammann Photogrammetric Engineers	43
Armco Drainage and Metal Products Company	23–24
Dorr-Oliver, Inc.	5–6
Edo Corporation	3
Fairchild Aerial Surveys, Inc.	20
Filotecnica Salmoiraghi, Inc.	11–12
L. B. Foster Company	16–17
Gulf Seal Corporation	4
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Kern Instruments, Inc.	8
Keuffel & Esser Company	18–19
Layne & Bowler, Inc.	38
Lock Joint Pipe Company	28–29
Masonry Resurfacing and Construction Company	10
The Master Builders Company	15
National Pool Equipment Company	44–45
Portland Cement Association	14
Ranney Method Water Supplies, Inc.	42
Raymond Concrete Pile Company	21–22
Sika Chemical Corporation	30
Soiltest, Inc.	31
Sonoco Products Company	32–33
Spencer, White and Prentis, Inc.	39
Sprague and Henwood, Inc.	27
Symons Clamp and Manufacturing Company	36–37
United States Steel Co.	7
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Angle Dozer Attachment

THE NEW ANGLE DOZER attachment for the Davis Loader has a unique angling device as well as 3 offset adjustments. The operator can back fill by "shaving in" the dirt while running parallel to the ditch. By pulling two pins, the attachment can be offset 7-in. to either side of center. The blade has a heat-treated cutting edge and its tilt and "bite" are hydraulically controlled. With its 28-in. moldboard height and 72-in.

Loader Attachment

width, this new product is suitable for all ordinary types of ditch back filling, moving snow, and also because of the angular tilt control, for cutting and cleaning ditches. **Massey-Harris-Ferguson, Inc., Industrial Div., CE 9, 1007 S. West, Wichita, Kansas.**

Compaction Unit

A NEW RUBBER-TIRED compaction unit, called the Graderoll, is designed for use with any tandem drive motor grader. It installs easily on the rear of the machine, thus converting the grader into a combination road-maintenance and pneumatic-compactor unit. In this way, compaction work is accomplished simultaneously with the blading of the

Graderoll

material. A key feature of the unit is a hydraulic lifting mechanism that connects to the grader's hydraulic system. In operation, the lifting mechanism raises the rear grader tandem tires about

(Continued on page 144)

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(continued)

4-in. from the ground, thus transferring a portion of the grader's weight to the specially designed compactor type tires on the Graderoll. Since each tandem drive housing supports a frame carrying a bank of 3 tires which can be independently raised or lowered about 14-in. from the ground, normal oscillating action is maintained. This insures constant ground contact of both the grader's front tandem drive and the pneumatic roller tires. Effective compaction weight on each of the 6 tires is about 1536-lb when working with a grader weighing 23,000-lb. **Midland Mfg. Co,, CE 9, P. O. Box 534, Columbus, Ohio.**

Self-Dumping Hopper

A NEW LINE OF SELF-DUMPING hoppers, engineered for industrial truck handling of wet or dry, cold or hot bulk materials, has recently been introduced.

These hoppers are designed for extra-heavy-duty service to provide maintenance-free continuous operation. They may be automatically dumped by releasing a gravity cam latch at the rear. After the load is dumped, the hopper rights itself and returns, locking positively and smoothly in the closed position, unable to disengage until again tripped by the operator. When not in use, the hoppers are self-stacking and nesting, without special lugs or attachments.

Automatic Hopper

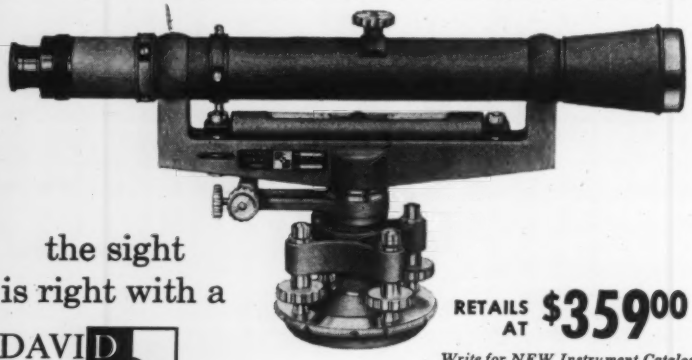
The equipment features all-electric welded construction of steel plate and structural steel. Five models are available with ½, ¾, 1, 1½ and 2-yd capacities. Lengths range from 49 to 74-in., widths from 40 to 52-in. and heights from 35 to 46-in. **Apex Welding & Fabricating Corp., CE 9, 30 Interstate St., Bedford, Ohio.**

Concrete Vibrator

A NEW SMALL DIAMETER internal concrete vibrator has high speed and low amplitude for consolidation of low slump concrete used in prestressed concrete manufacturing. The 10½-in. head with a diameter of 1⅝-in. is ideal for stems of "T" members and hard-to-reach areas. The interchangeable, flexible shaft drive is obtainable in either 14-in. or 24-in. lengths, weighing 16 and 17-lb respectively. **Viber Co., CE 9, 726 South Flower St., Burbank, Calif.**

Semi-Automatic Welding Unit

A NEW SEMI-AUTOMATIC, completely equipped, submerged arc welding unit, with all controls and control power cable for plugging in on 110-v, has recently been announced. A gun cable assembly is included with 2-interchangeable welding guns—a flux type with hopper and an open arc type for non-flux welding. The wire feed speed control rheostat and electrical components are protected by steel cabinets which may be used as one unit or separated for remote control. Cooling is provided by bottom and openings and side panel louvres. The wire feed mechanism and wire straightener are accessible through a hinged door. The wire reel assembly is secured to the base by 4 wing nuts and can be easily removed. The head is also removable making it still easier to transport the basic unit. Designed for use



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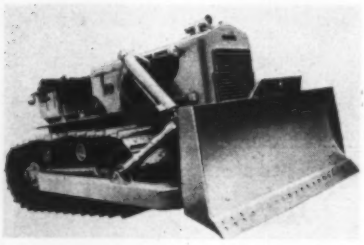
with any arc welder having continuous current up to 500-amp, it uses solid wires 5/64 or 3/32-in. and tubular wires 3/32 or 7/64-in. with either gun. **Hobat Bros. Co., CE 9, Hobart Square, Troy, Ohio.**

Mounted Bulldozer

THE 133 DRAWBAR HP MODEL crawler OC-18 is now available with a new engine-framed mounted bulldozer. A strong, simple hookup arrangement is used to anchor the hydraulic cylinders to the engine frame on both sides. Heavy box-section push arms pivot on the track frame and have far-back mounting point for a blade lift above ground of 47¾-in. The drop below ground is 14¼-in. for an over-all blade travel of 62-in. The 10-ft 10-in. wide blade has reversible cutting edge and end bits and can adjust to 14½-in. maximum tilt. The over-all length of the OC-18 with its blade straight is 17-ft 11-in.



OC-18

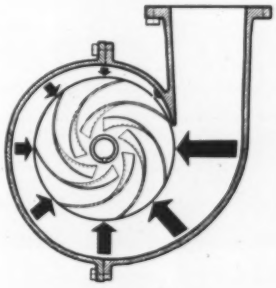
The OC-18 features "power-turn" steering, into which clutch is integrated to permit spot turns by locking of the pivot track. For gradual turns, there is power on both tracks at all times. Instant speed reduction is made possible by the "power-turn" planetary reduction drive. A quick pull of the controls gives a speed decrease of 38% and an increase in drawbar pull of up to 60%, depending upon weight and traction. **Oliver Corp., CE 9, 400 W. Madison St., Chicago 6, Ill.**

Scarifier-Ripper

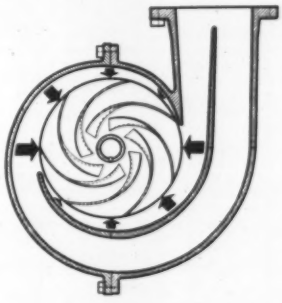
FOR THE FIRST TIME IN self-propelled scraper design, a scarifier-ripper has been built in as an integral part of the machine. The scarifier serves 2 purposes: it can be hydraulically lowered on the back haul to rip the soil for the loading runs; it is a counterweight for better traction and stability. Balance of the closed-coupled, short-wheelbase unit assures traction to absorb full engine torque, thus providing efficient self-loading action. The Utility Scraper is expected to find wide application on highway shoulder and widening work because it is well within highway limitations for both over-all width and axle

Utility Scraper

loadings. It can make 180-deg turns on a 22-ft roadway. Capacity is 4.5-cu yd struck and 6.0-cu yd heaped. The scraper, which weighs about 16,000-lb, is powered by an International 650 Diesel tractor modified as an 88-hp 2-wheel prime mover. All steering and scraper controls are hydraulic. Its 5 speeds range from 2.4 to 21-mph. Maximum cutting depth is 4-in., width is 7-ft and spread is from 2 to 14-in. **Seaman-Gunnison Corp., CE 9, Milwaukee, Wis.**



Drawing showing unbalanced pressures acting on impeller and shaft in single volute pump whenever it is operating at below peak efficiency.



Drawing showing how radial forces are equalized in Wheeler-Economy Dual Volute Centrifugal Pumps. Note that the inlet for each volute is 180° from the other.

How Wheeler-Economy

Dual Volute Design

prolongs pump life by equalizing radial forces acting on pump impeller and shaft

Operating high-head, high-capacity centrifugal pumps at less than peak efficiency—even intermittently—can cause considerable trouble. Forces of five to ten times the weight of the rotating parts are set up, often with the result that the pump shaft breaks, the casing rings wear prematurely and the stuffing box leaks.

Wheeler-Economy Dual Volute design solves these problems by forcing the liquid to accelerate and decelerate at a uniform rate regardless of load. As you can see from the sketch, liquid leaving the impeller at the "nine o'clock" position enters one volute; liquid leaving at "three o'clock" enters the other. In this way, radial pressures at each point along the impeller periphery are balanced by equal and diametrically opposite pressures—eliminating eccentric wear of stationary parts and pump shaft fatigue failure.

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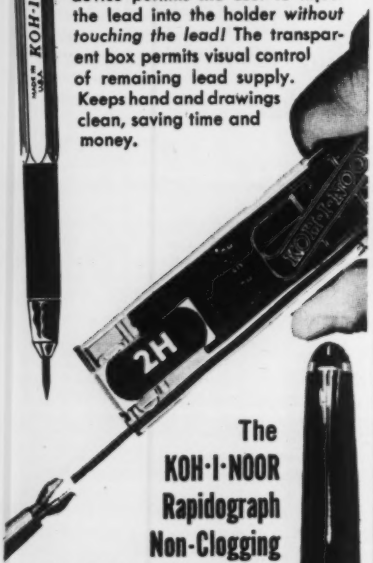

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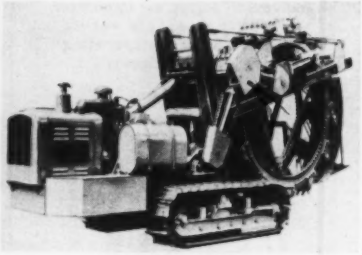
EQUIPMENT MATERIALS and METHODS

(continued)

Trenchliner

ONE OF THE FEATURES on the new 170 trenchliner is a hydraulically driven conveyor that provides belt speeds up to 600-ft per min, yet works independently of the wheel speeds. Therefore, it is possible to place spoil at a convenient distance from the trench wall when wheel speeds are slowed due to hard digging conditions. The 170 will produce from 12-in. to 25-ft of trench per min in a range of 30 digging speeds. Maximum digging depth is 5-ft 9-in.

The digging wheel is hydraulically raised and lowered on a vertical mast to hold close grade tolerances at desired digging depths. A separate mast tilt ram holds the mast vertical and tilts it forward for proper balance and clearance when traveling or loading. Power is furnished either by a standard 60-hp gasoline or 54-hp diesel engine. Tractor type crawlers with replaceable links, pins and bushings can be either standard 16-in. grouser type or 12-in. flat shoe type.



Parsons 170

Other features include an all-welded steel frame, a dual purpose friction type clutch and oil bath lubricated gears with sealed shafts mounted on antifriction bearings. A selection of 7 cutting widths are available, extending from 20 to 32-in., in 2-in. increments. **Parsons Co., CE 9, Newton, Iowa.**

Clam Shell Buckets

A NEW LINE OF FAST release, easy operating production clam shell buckets has been developed for excavating, dredging and material handling operations. They feature carefully calculated inside and outside arm lengths which together with the proper distribution of weight and a unique pulley design result in a bucket that opens and closes with extreme speed and has exceptional digging efficiency. The cutting teeth and cutting lip are forged of the new T-1 steel, a low-carbon, quenched and tem-

(Continued on page 147)

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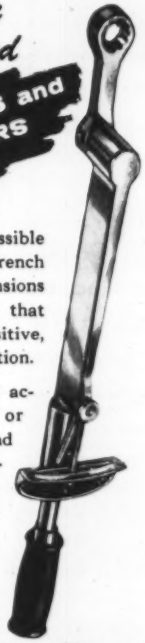

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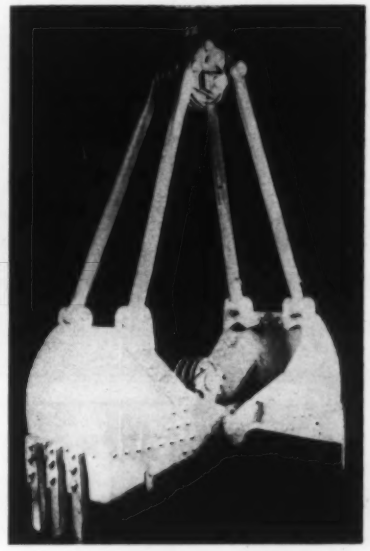
EQUIPMENT MATERIALS and METHODS

(continued)

pered alloy plate steel, which combines a high yield strength, 90,000-psi or more, providing extreme bucket durability and reducing downtime for the operator. The shells and head are of welded construction, another feature adding to its integral unit design. Block and tackle type reeving keep cables and pulleys out of



contact with the material and allows equal transmission of force to all 4 arms, as well as permitting a lower center of gravity to allow fast opening and closing cycles. The buckets can be furnished with bottom teeth or with bottom and side teeth. All component parts are interchangeable in 5 different sizes. **Hutton Fabricating Mfg. Co., CE 9, 2736 East 79 St., Cleveland 4, Ohio.**

Centrifugal Pump

THE NEW COMPACT "Motor-Mount" centrifugal pump, featuring rapid, automatic self-priming, is designed for swimming pools and lawn sprinkling service, pit drainage, sump level control and general liquid handling. No. 3350 is available in 2, 3 and 5-hp sizes. No. 3351 ranges from ⅓ to 1½-hp and provides a high capacity pump with low head or a low capacity with high head, without 2 distinct or separate designs. Construction features include a bronze impeller, stainless steel shaft, mechanical seal and built-in motor overload protection on 2-hp and smaller motors. **Deming Co., CE 9, 42 Broadway, Salem, Ohio.**

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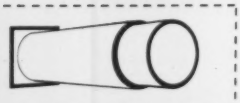

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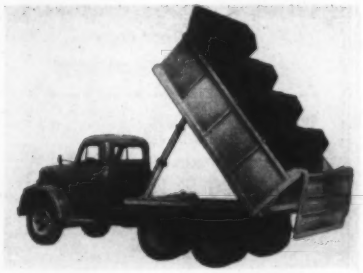

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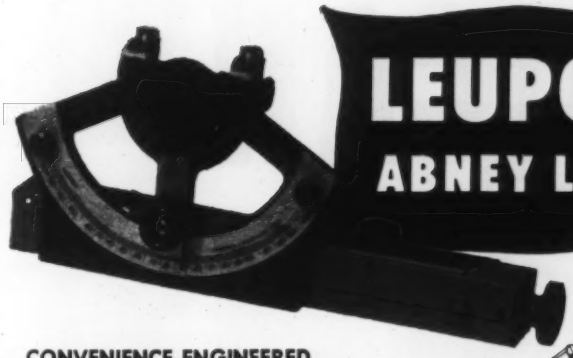
11½-ft long, has a capacity of 8-cu yd without the cement boxes which are removable. The floor and tailgate are 10 gauge; the sides are 12 gauge. Full floor support is provided by longitudinal sills of structural steel channel and outrigger type crossmembers. A reinforced front end prevents bulging and supports an anti-spill cab shield. The air-controlled tailgate has a "boxed" type reinforcement with 4-proof down hook latches. **Anthony Co., CE 9, 94 Reinhard St., Streator, Ill.**

Sealing System

A NEW CONCEPT FOR SEALING glass in skin wall construction eliminates caulking and permits streamlined installation that cuts cost drastically. A special neoprene weather-tested gasket arrives at the construction site as a unit and is easily snapped around the pane by one workman. A movable stop applies pressure to the gasket, providing a uniform, permanent seal between glass and frame. The resiliency of neoprene allows the glass to bend under heavy winds, reducing breaking possibilities. If the glass should break, the same aluminum frame and the rubber gasket can be reused to replace the light. Resilient neoprene also allows the gasket to absorb thermal expansion and contraction of the glass skin walls. The gasket was manufactured by the Pawling Rubber Corp. for the New York International Airport Arrivals Building, which is completely enclosed with thousands of glass panes of various kinds and sizes. **E. I. DuPont de Nemours & Co., CE 9, Wilmington 98, Del.**



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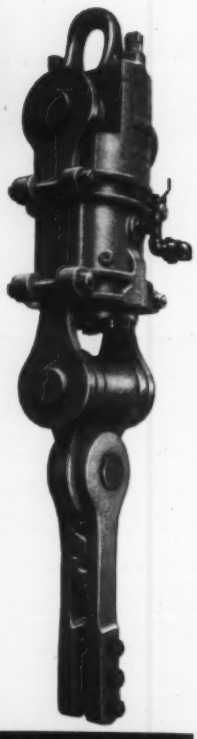

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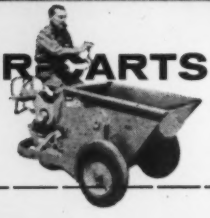

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WHEELBARROWS	3 to 5 cu. ft.	200 ft.	walking	1 to 1½ cu. yds.

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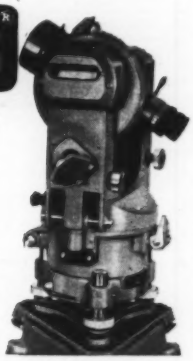

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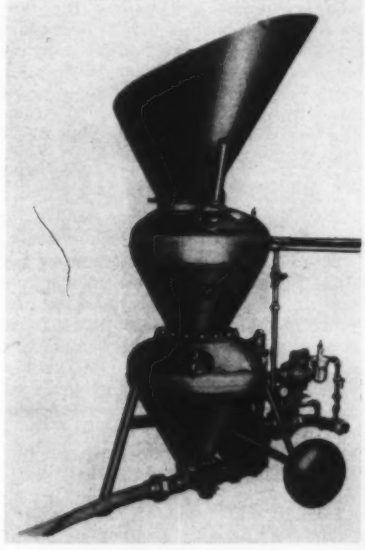

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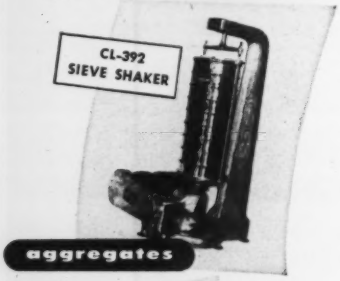

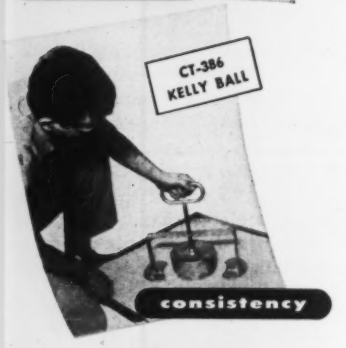

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ROAD SHOULDERS—The new 16-page illustrated booklet, "Shoulder Stabilization with Calcium Chloride," is designed specifically to aid the highway engineer and contractor in planning the work ahead in the new highway program. This calls for wider shoulders that are usable by all classes of vehicles in all weather. Stabilized aggregate shoulders have been proved safer because the hazardous drop-off at the pavement edge is eliminated. Moreover, they are dustfree, and maintenance requirements are cut in half. The booklet contains specifications as well as established methods for their construction, reconstruction and maintenance. **Calcium Chloride Institute, CE 9, 909 Ring Building, Washington 6, D. C.**

WASTE TREATMENT—An article, entitled "Sall Mountain's Unusual Effluent Treatment Plant," has been reprinted for those interested in an efficient and economical solution to such problems. Reprint 72 deals with waste treatment in a plant specializing in the manufacture of asbestos papers. Plant objectives, which have been most satisfactorily realized, were recovery of water for process requirements and reclamation of suspended solids for reuse in paper production. **Infilco, Inc., CE 9, Tucson, Arizona.**

BRIDGE WIRE—A new 22-page publication, which is specific to wire, strand and rope used on guyed structures and suspended systems of all kinds, except the gigantic suspension bridges, is now available. It consists of chapters on galvanized wire, galvanized bridge strand, galvanized bridge rope, fittings and special fittings. Fully diagramed, it includes complete specifications. **John A. Roebling's Sons Corp., CE 9, Trenton 2, N. J.**

TIDE GATES

Fig. B-68, Type M
(CIRCULAR)

Fig. B-61, Type MM
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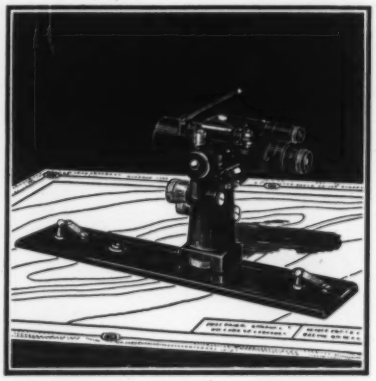

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"Sui"—One of the most unusual engineering and construction feats of recent times, the building of the 348-mi gas pipeline across the Pakistan desert, is the subject of a new 26-min film presented by the World Bank. The film tells of the discovery of one of the world's largest natural gas deposits in Pakistan in 1932, and of the revolutionizing potential it held for this country of limited industrial capacity. **Association Films, Inc., CE 9, 347 Madison Ave., New York 17, N. Y.**

"Pulpwood Logging"—The growth of the pulpwood industry is presented in a new 23½-min sound-color film, which also illustrates the importance of mechanization, placing emphasis on the many jobs that are profitably handled in this manner. Pulpwood logging is shown under varying conditions—from thick underbrush to dense snow-drifted forests. Also covered are the details of wood operations: forest site preparation, cutting, hauling and loading logs for mill delivery. **Caterpillar Tractor Co., CE 9, Advertising Division, Peoria, Illinois.**

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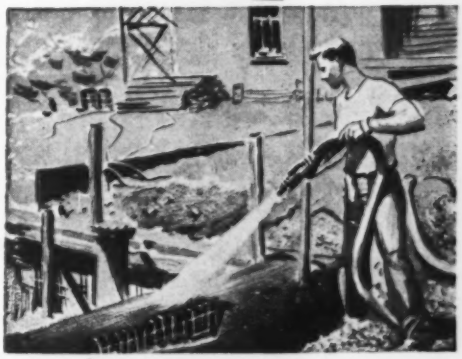

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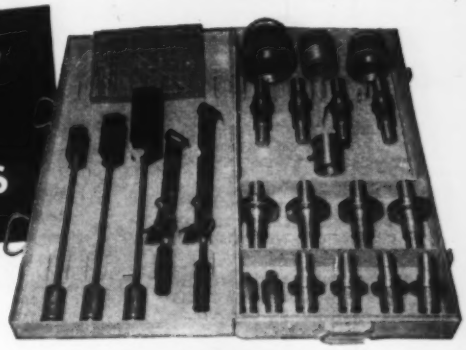

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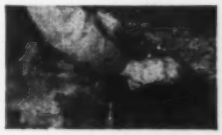

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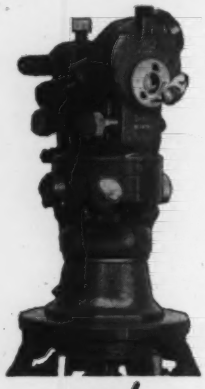

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RE-ELECTION: Louis F. Fontana, Sales Manager of the Irving Subway Grating Co., Inc., was re-elected president of NAAM for the year 1957-8 at the Association's 19th Annual Convention in San Francisco . . . **NEVER-ENDING DAYLIGHT:** The installation of specially designed General Electric mercury quartz vapor lamps and floodlights will provide never-ending "daylight" for New York International Airport's Terminal City. This is believed to be the world's largest installation of blanket floodlighting . . . **USED EQUIPMENT:** International Harvester has announced the VM (Value Measured) Used Equipment plan under which the machine will be reconditioned, the value of each major component measured, and then sold through I-H distributors . . . **NEW PLANT:** Excavator production has begun in the new plant built for Bucyrus-Erie Co. of Canada, Ltd. in Guelph, Ont. The new staff is expected to number about 150 . . . **RECORD POUR:** The largest known concrete pour in the Chicago area, 1902-cu yd in 8 hours, was made recently during construction of the prestressing plant of American Marietta's Lewistown Pipe Div. near LaGrange, Ill. . . . **SALES OFFICE:** The Florida Div. of Food Machinery and Chemical Corp. announces the formation of a sales and manufacturing operation for their line of Form-Crete All Steel prestressed concrete casting forms in Riverside, Calif., which will serve all states west of the Rocky Mts. . . . **RECORD OPENING:** The United States Steel Corp. has been credited with a large role in the record reopening of 3 of Oklahoma's important highway bridges damaged by the spring floods. Route 66 bridge was put back into service within a month, less than a third of the time normally required . . . **RETIRED:** G. H. Olson, a vice president and director of Link-Belt Speeder Corp. retired on July 1 after 47 years of service . . . **DEMOUNTABLE UNIT:** A demountable earth boring machine which can be removed from the truck when not in active use and allow the vehicle to be utilized for other purposes, has been developed jointly by the Signal Corps and Highway Trailer Co. Further extensive tests are now taking place . . . **WORLD'S LARGEST WORLD:** The largest globe-of-the-world mapped to scale is a steel Hortonsphere containing 600,000-cu ft of gas at 75-lb per sq in. for the supply lines of the South Atlantic Gas Co. in Savannah, Ga. Constructed by Chicago Bridge & Iron, it is 60-ft across and 189-ft around the equator . . . **APPOINTMENTS:** E. Roy Grant has been named assistant manager of the Rocky Mountain Div. of Armco Drainage & Metal Products, Inc. . . . James P. Beyser has been appointed General Manager of the Verona, Pa. plant of The Ingalls Iron Works Co.

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PROCEEDINGS AVAILABLE

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July

1326. Airfields on Permafrost, by Kenneth A. Linell. (AT) This paper outlines special problems of constructing airfield pavements on permafrost foundations. Particular attention is devoted to problems of construction in areas of discontinuous permafrost. Importance of non-frost-susceptibility soils is shown, and means of combating degradation of pavements are carefully explained.

1327. White-Out, A Hazard to Arctic Flying, by R. W. Gerdel and M. Diamond. (AT) The studies on Arctic white-out reported in this paper were conducted at a field research station located on the Greenland ice cap. The paper discusses five white-out phenomena, analyzes the possibility of forecasting these phenomena, and suggests methods of dispersal.

August

1330. Hurricane Effect on Sea Level at Charleston, by Bernard D. Zetler. (HY) Tropical cyclones from 1922 to 1955 have been classified according to the orientation of their tracks with respect to Charleston Harbor. Theoretically, the displacement of sea level depends on this orientation; the tabulated displacements caused by tropical cyclones during 34 years of tide observations bear out the relationships.

1331. Systematic Changes in the Beds of Alluvial Rivers, by Walter C. Carey and M. Dean Keller. (HY) This paper describes the sand wave formations present in alluvial rivers and discusses their variation with respect to river stages. The related rise and fall of crossings is also discussed. The illustrations are prepared from fathometer surveys and show the changes in the sand waves due to changes in stage.

1332. Synthetic Storm Pattern for Drainage Design, by Clint J. Keifer and Henry Hsien Chu. (HY) A method for deriving a synthetic storm pattern from local rainfall records is presented. The result is a single storm pattern encompassing the effects of storms of different durations. The storm pattern is a prerequisite of the hydrograph method for attacking the drainage design problem.

1333. Sanitary Sewage Disposal in Subdivisions, by Paul W. Richards. (SA) One of the major sanitary problems lies in the satisfactory disposal of sanitary sewage from subdivisions. A discussion of the problem and some efforts directed towards its solution are given.

1334. Adsorption and Assimilation in Activated Sludge, by Charles Smallwood. (SA) Activated sludge is widely used for the stabilization of sewage and industrial wastes. Evidence is presented to show that the soluble organic matter is removed from solution by assimilation while suspended and colloidal organic matter is removed by adsorption.

1335. Direct Recharge of Ground Water with Sewage Effluents, by R. B. Krone, P. H. McGauhey, and H. B. Gotaas. (SA) The paper presents results of a three-year study in which sewage effluents were injected directly into a confined aquifer and the travel of pollution observed in twenty-three surrounding sampling wells. The technical feasibility and public health safety of direct recharge of ground waters were established by the field scale experiments described.

1336. Trickling Filters Successfully Treat Milk Wastes, by Paul E. Morgan and E. Robert Baumann. (SA) More data is needed by the milk industry regarding successful methods of waste treatment. This paper discusses the volume and strength of wastes discharged, and unit loadings and efficiencies at two waste treatment plants that have proved successful.

1337. Sewage Treatment by Raw Sewage Stabilization Ponds, by W. W. Towne and W. H. Davis. (SA) Data from studies carried out by the Texas State Department of Health and the U. S. Public Health Service in cooperation with North and South Dakota are discussed in this paper. Factors affecting the process of purification, and design of stabilization ponds are also considered.

1338. Public Health Service, Stream Pollution Abatement Program, by Lewis A. Young. (SA) The paper discusses reasons why engineers should be interested in stream pollution abatement. The new Federal Water Pollution Control Law is considered, as well as the importance of protecting our water resources.

1339. The Variable-Angle Launcher: A Naval Ordnance Testing Facility, by John L. Cox. (CO) A unique, high-speed, water-entry, missile-testing facility involving unusual design and construction is operated at Morris Dam in Southern California by the Naval Ordnance Test Station. This paper is the first of five describing general features, concrete

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structures and foundations, steel structures, mechanical-electrical equipment and construction.

1340. Variable-Angle Launcher: Concrete Structures and Foundation Treatment, by James H. Jennison. (CO) This second paper on a water-entry, missile-testing facility describes the pyramid-shaped concrete structure which carries heavy moving loads and large recoil forces. The foundation on a steep slope was stabilized by pressure-grouting the numerous fissures in the rock. High-density concrete was used in a 600-ton counterweight car designed as a composite beam.

1341. Variable-Angle Launcher: Steel Construction, by N. D. Whitman, Jr. (CO) This third paper describes the design features of the moveable all-welded 300-ft launching bridge with its supporting 95-ft bridge and related steel structures. The application of welded design to heavy structural fabrication is discussed and illustrated.

1342. Variable-Angle Launcher: Mechanical and Electrical Features, by Francis L. Carlisle. (CO) This fourth paper in a series on a facility for studying high-speed water-entry of aircraft-launched torpedoes presents problems encountered in the design of machinery, electrical installations and instrumentation. Many unusual designs were required, including a high-pressure quick-acting air valve and tuned-mass vibration dampers for a large compressor.

1343. Variable-Angle Launcher: Construction, by Arthur C. Bravo. (CO) This last paper of the series describes the problems encountered in the construction of the Variable-Angle Launcher. Methods used in welding large structures, in transporting the 300-ft all-welded bridge and in guniting a slab on a 30 deg slope are illustrated, as well as the construction of a thick concrete slab on a 45 deg slope.

1344. Multi-Layer Penstocks and High Pressure Wyes, by Ewald Schmitz. (PO) Multi-layer penstock design and fabrication with field welding procedures is described with illustrations of installation in service. Construction features of several high pressure different wye designs are illustrated.

1345. Characteristics of Flow over Terminal Weirs and Sills, by P. K. Kandaswamy and Hunter Rouse. (HY) Generalized experimental results are presented to show the variation in both the discharge coefficient and the nappe profile for two-dimensional flow over a vertical sharp-crested weir at the end of a horizontal channel as the ratio of head to depth of flow changes continuously from zero to unity.

1346. Discussions of Proceedings Papers 997, 1184, 1216. (PO) M. Rocha, J. Laginha Serafim, A. F. da Silveira closure to 997. Paul H. Jeynes, Bert J. Blewitt, C. W. Bary and W. T. Brown on 1184. Carroll E. Withers on 1216.

1347. The 1957 ASCE Salary Survey, Donald H. Mattern, Chairman. (BD) The 1957 report of the Society's Committee on Salaries constitutes the fourth in the biennial series of salary surveys conducted by the Committee. Consonant with its purpose as stated in the By-Laws of the Society to ". . . collect, codify and prepare for distribution such data as may be calculated to be of value to employers of civil engineers and to civil engineering employees in connection with the proper classification of engineering positions and equitable compensation for such services," the Committee here presents the results of its 1957 survey.

1348. Discussions of Proceedings Papers 1009, 1034, 1162, 1165, 1166, 1167. (HY) Wen-Hsiung Li and Calvin C. Patterson closure to 1009. Emmett M. Laursen closure to 1034. Charles E. Behlke, Steponas Kolupaila on 1162. G. N. Alexander, Steponas Kolupaila on 1165. Corrections to 1166. M. A. Benson on 1166. Turgut Sarpkaya, G. Dugan Johnson, Henry Voltmann, Ronald E. Nece on 1167.

1349. Discussions of Proceedings Papers 1178, 1179. (SA) Casimir A. Rogus on 1178. Judson P. Elston on 1179.

1350. Bibliography: Underground Hydroelectric Power Plants, by J. Barry Cooke and Arthur G. Strassburger. (PO) Underground hydroelectric plants are being adopted to an increasing extent throughout the world, except in the United States. The paper presents a review of existing general literature, a brief discussion, a list of the world's underground hydroelectric plants with some general data, and a chronological bibliography including brief resumes.

1351. Arch Dams: The Development of Model Researches in Italy, by Guido Oberti. (PO) Experimental researches on models in Italy have greatly contributed to the national design of arch dams. Actual possibilities of models based on the theory of similitude are discussed. Important cases of Italian arch dams studied by models are described and principal results obtained are reported.

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Index To Advertisers

Acker Drill Company, Inc. 153
Aero Service Corporation 95
Allis-Chalmers Manufacturing Company . . . . 27, 28 and 29
Aluminum Company of America . . . . . 14 and 15
American Bitumuls & Asphalt Company 8
American Bridge Division . . . 21, 22, 23, 24, 110 and 111
American Cast Iron Pipe Company 10
American-Marietta Company 33
American Steel & Wire Division . . . . . 21, 22, 23 and 24
Armco Drainage & Metal Products, Inc. 129
Aurora Pump Division, The New York Air Brake Company 35

Barco Manufacturing Company 25
C. L. Berger & Sons, Inc. 120
Bethlehem Steel Company . . . . . 34 and 119
Blaw-Knox Company 36
Boeing Airplane Company 133
Borden Metal Products Company 2
Bristol Steel & Iron Works 40
Brown & Brown, Inc. 152
Builders Providence, Division of B-I-F Industries, Inc. . . . 93

Cast Iron Pipe Research Association . . . . . 6 and 7
Chicago Bridge & Iron Company 38
Columbia-Geneva Steel Division . . 21, 22, 23, 24, 98 and 99
Consolidated Western Steel Division . . . 21, 22, 23 and 24
Copperweld Steel Company 141
Cyclone Fence Department . . . . . 21, 22, 23 and 24

Albert G. Daniels 140
Eugene Dietzgen Company 152

Eagle Pencil Co. 115
Earle Gear & Machine Company 149
Electrovert, Ltd. 31

Fairchild Aerial Surveys, Inc. 30
Filotecnica Salmoiraghi, Inc. 32
Food Machinery and Chemical Corporation, Florida Division 122
Forney's Incorporated, Tester Division 147
Franki Foundation Company 9

Gar-Bro Manufacturing Co. 150
General Electric Company 136
Griffin Wellpoint Corp. 130
C. L. Guild Construction Co. 20
W. & L. E. Gurley 105

Ideal Cement Company 97
Infilco, Inc. 37
International Harvester Company . . . . . 116 and 117
Intrusion Prepakt, Inc. 5
Irving Subway Grating Co., Inc. 151

Kargl Company, Inc. 148
Kern Instrument, Inc. 154
Koh-I-Noor Pencil Co. 146

Layne & Bowler, Inc. 13
Lehigh Portland Cement Co. 12
Leupold & Stevens Instruments, Inc. 149
Lincoln Electric Company 113
Lock Joint Pipe Company . . . . . 4th cover
Lone Star Cement Corp. 42

M & H Valve and Fittings Company 118
The Master Builders Company . . . . . 3rd cover
Mayo Tunnel & Mine Equipment 146
W. R. Meadows, Inc. 143
Miller Sewer Rod Co. 128
Moretrench Corporation . . . . . 124 and 125

National Clay Pipe Manufacturers, Inc. 1
National Pool Equipment Co. . . . . 2nd cover
National Tube Division . . . . . 21, 22, 23 and 24

Omega Machine Company, Division of B-I-F Industries, Inc. 18
Ozalid, Division of General Aniline & Film Corporation . 109

Phoenix Bridge Company 154
Pipe Linings, Inc. 148
Portland Cement Association 107
Pressure Concrete Co. 153

Raymond Concrete Pile Co. 121
Richmond Screw Anchor Company, Inc. 139
H. H. Robertson Company 19
John A. Roebling's Sons Corp. 127

Sika Chemical Corp. 131
Simplex Valve & Meter Company 4
Soiltest, Inc. 152
Solvay Process Division 141
S. Morgan Smith Co. 16
Sonoco Products Company 112
Spanall of the Americas, Inc. 17
Spencer, White & Prentis, Inc. 146
Sprague & Henwood, Inc. 114
J. S. Staedtler, Inc. 126
Standard Oil Company (Indiana) 123
Stanpat Company 147
P. A. Sturtevant Co. 147
Sverdrup & Parcel, Inc. 136

Tennessee Coal & Iron Division . . 21, 22, 23, 24, 98 and 99
Tinney Drilling Co. 151

Union Metal Manufacturing Co. 11
United States Steel Corp. 21, 22, 23, 24, 98, 99, 110 and 111
United States Steel Export Company . . 98, 99, 110 and 111
United States Steel Supply Company 21, 22, 23, 24, 98 and 99
Universal Form Clamp Co. 26
Universal Atlas Cement Company . . . . 21, 22, 23 and 24

Vulcan Iron Works, Inc. 150

Warren-Knight Company 141
Western Electric Company 135
C. H. Wheeler Manufacturing Co. 145
The David White Instrument Co. 144
Wild Heerbrugg Instruments, Inc. 151
John Wiley & Sons, Inc. 137

Professional Services . . . . . 157, 158 and 159

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